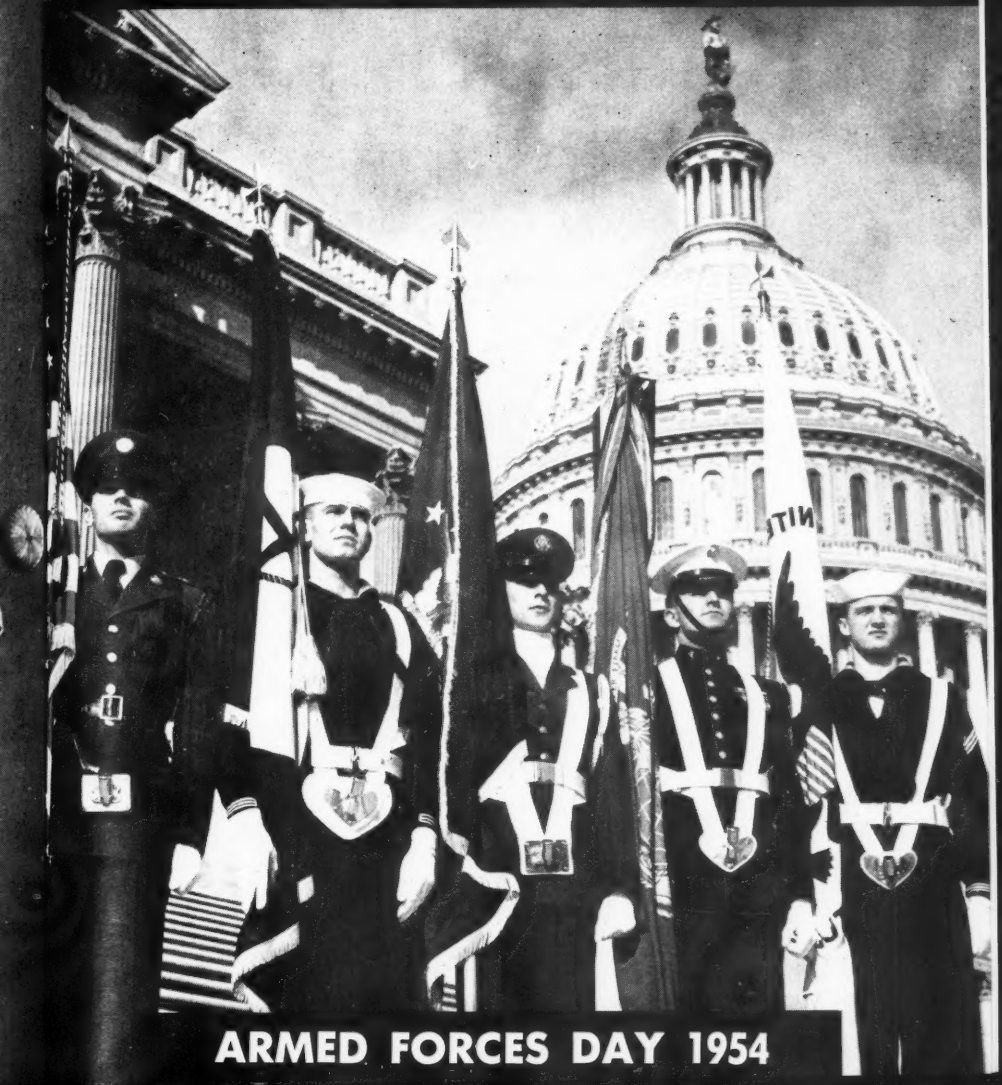
MAY 1954

ARMY INFORMATION DIGEST



ARMED FORCES DAY 1954

In This Issue:

A DEDICATED ARMY. Among professional Army personnel—officer and enlisted alike—patriotism is more than a matter of attitude or sentiment; it is a living deed, to be carried to the point of supreme sacrifice whenever duty or the Nation's safety requires it. "If I had to find a single word by which to characterize the officers of the United States Army, that word would be integrity—absolute, uncompromising integrity," the Secretary of the Army states in the lead article. Numerous examples of heroism, pioneering and dedicated service in peace and war illustrate how "Army Leadership Serves America's Future."

ROLES, MISSIONS AND CAPABILITIES of the Army, Navy and Air Force are analyzed by top-ranking authorities in three articles. The Army Chief of Staff discusses "The Army's Role in National Defense"; the Chief of Naval Operations previews "The Navy's Part—If War Comes"; and the Vice Chief of Staff, United States Air Force, tells how the Nation is to be safeguarded by "Our Defense in the Air."

THE COLOR GUARD standing shoulder to shoulder on the front cover symbolizes the solidarity of the armed services. The fifth Armed Forces Day is observed on 15 May this year, but every day finds the principles of inter-service co-operation being applied at every level.

THE GUIDED MISSILE poised for antiaircraft defense on the back cover may be the newest thing under the sun, but its propulsive principle was familiar to the Chinese, Arabs and Hindus centuries ago. Francis Scott Key immortalized "the rocket's red glare" during the siege of Fort McHenry. Rockets which brought devastation to Boulogne and Copenhagen during the early nineteenth century, and which United States troops employed in the Mexican War, have again come into prominence, this time radar controlled or electronically guided and with destructive potentialities multiplied many fold. Appropriately, all three services are engaged in research to enhance the effectiveness of "Rockets in Warfare."

IN THE ARENA OF WAR, there is no umpire to call off the contest on account of darkness. Under artificial daylight generated by searchlights, flares and illuminating shells, attacks can be continued as long as feasible, while the enemy is denied the infiltration and reinforcement opportunities which darkness usually affords. Illumination by direct and indirect methods enables the unit commander to conduct "Battle Without Darkness."

ARMY INFORMATION DIGEST

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U. S. Army Photograph

ROBERT T. STEVENS

Army Leadership Serves America's Future

Robert T. Stevens

OF THE MANY THORNY PROBLEMS confronting the Nation as it strives to deal realistically with the Soviet threat of aggression, one stands out as being of such fundamental importance that it cannot be too often or too strongly stressed. This is the problem of insuring the continuous development of the highest quality of military leadership. It is indeed a matter of grave consequence, particularly in view of our normal dependence upon relatively small active forces which must be rapidly and enormously expanded to meet a war emergency.

Great leadership is a priceless military asset, and the lack of it can never be offset by numbers of men, by a preponderance of guns and tanks, of planes, bombs, ships or any other material things, no matter how good they may be, how modern, how powerful. No matter how large and well-equipped, a military force which goes forth to battle without fine leadership—not only at the top but all down through the ranks—marches toward defeat and disaster.

We certainly have fine leaders today. Never before have we had available so many senior officers tempered in the fires of war, thoroughly versed by experience in the command of large bodies of men and practiced in the solution of military problems of the first magnitude.

For more than a year now, as Secretary of the Army, I have worked in close association with a great many of these highly competent officers upon whose shoulders rests a major part of the burden of our national security. I have the most profound respect for their unalloyed patriotism, their zeal, their high

From an address by THE HONORABLE ROBERT T. STEVENS, Secretary of the Army, at ceremonies installing General Mark W. Clark as President of The Citadel, Charleston, South Carolina.

character and intelligence, and their professional stature. In my visits to the Far East, to Europe, and to installations throughout the United States I have become acquainted with all our top commanders in the field, and I have brought back with me a firm belief in their great capacity and unsurpassed devotion to the Nation.

We are also fortunate in having the kind of enlisted men who make up the bulk of our Army. I have seen them under the stress of battle, I have seen them standing guard at far-flung outposts, and I have seen them undergoing their gruelling training. I have talked to them and I have come to know them. And, knowing them, I am resolved that they shall continue to have the finest possible leadership—they deserve no less.

The bravery and capability of the American soldier is written large on the pages of history. How often the words "valor above and beyond the call of duty" have been his epitaph! I want to tell you about two American soldiers in particular. I pick them from the thousands because only recently it was my solemn privilege to present to their parents Medals of Honor which had been awarded posthumously.

One was Sergeant First Class Ray Duke of Tracy City, Tennessee. Sergeant Duke, who was in action against the enemy in Korea, learned that several of his men were isolated and heavily engaged in an area from which his platoon had been ordered to withdraw. He led forward a small force which recovered the position and the trapped men. The enemy attacked and Sergeant Duke, although wounded by mortar fragments, calmly moved along his platoon line to direct the fire of his men and encourage them. Wounded a second time, he received first aid and returned to his position.

When the enemy attacked again shortly after dawn, the sergeant, despite his wounds, continued to supervise the defense of each position. The platoon was threatened with annihilation, and had again been ordered to withdraw when Sergeant Duke was wounded a third time. Both legs were injured. Unable to walk and realizing that he was impeding the progress of the comrades who were carrying him, he instructed them to leave him behind. He was last seen pouring devastating fire into the ranks of the onrushing enemy.

The other man was Private First Class Charles George of Whittier, North Carolina. While a member of a raiding party,

he leaped into a Communist trench and closed with the enemy in hand-to-hand combat. When the patrol was ordered to withdraw he remained behind with two companions to cover its withdrawal. When a hostile soldier hurled a grenade into the midst of the trio, Private First Class George unhesitatingly threw himself upon the grenade and absorbed the full force of the blast. Although terribly wounded, he refrained from crying out in order not to reveal the position of his comrades. They eventually managed to get him to an aid station, but he died.

These two instances are vivid examples of the courage of the American soldier, and I include all ranks—for valor is found at every level in the Army.

The Army's brilliant Chief of Staff, General Ridgway, for example, is well known for his personal bravery and inspirational leadership in battle. He parachuted into Normandy to spearhead our assault on the Nazi-held peninsula. When he commanded the XVIII Airborne Corps it was said that "at the furthest point of advance of Ridgway's Corps you would always find the corps commander, the division commander, the regimental commander and any rifleman who could keep up."

Our senior officers set the standards for courage by their own actions. Virtually everyone is familiar with the heroic exploits of General Dean in Korea. During World War II, General Clark made a perilous landing from a submarine on the enemy-occupied North African coast for a secret meeting with a group of French officers to arrange details of the invasion which was to follow. General Taylor, at present commanding our Eighth Army in Korea, had himself smuggled into enemy-held Italy, in order to confer with Marshal Badoglio about terms of the Italian surrender. After a hazardous trip past road blocks, German sentries, and innumerable other dangers, he successfully completed his mission, although his life was in constant peril.

These are but a few of many examples I could mention to illustrate the kind of men of which this Army is composed. I reaffirm to all America today what a wonderful United States Army we have. After all, it did produce the President of the United States. It did produce Generals Ridgway, Marshall, Bradley, MacArthur, Collins, Clark, Clay, Van Fleet, Taylor, Gruenther, Hull—to mention only a few of the great soldiers who, in the past decade, have brought high honor to the uniform.

This Army began with George Washington, and its fidelity

and determination in the dark days of Valley Forge were all that kept the flickering spark of liberty alive. In truth it created the opportunity for the United States of America to exist as a free Nation, and to become a *great* Nation.

In less than two centuries a wilderness has been transformed into one of the greatest world powers in history. No element in American society has made a more valuable, more selfless, more consistently outstanding—and more generally unacknowledged —contribution to that development than the United States Army.

Its primary mission, of course, is to insure the military security of the United States, and the challenge of war has ever found it capable of almost incredible feats. Careful preparation and study by the Army's officers, despite decades of public neglect of the military, made possible the tremendous achievements of World War I. The United States Army successfully carried out a tremendous expansion in a few short months. It organized, trained, supported and took into combat a great military force which tipped the balance in favor of the Allied Powers and brought about the defeat of the German aggressor.

Similarly, in 1941, the skill and vigor of our Army officers, and their years of experience and study, enabled America to create in a relatively short time the greatest army in all history. That army proved its quality in North Africa and Italy, on the Normandy beaches, on the islands of the Pacific—in the tropics, in the desert, in the mountains, and in the frozen Arctic.

And then Korea. Surely no army in history has fought more nobly under more trying conditions. It was outnumbered from the beginning, confronted by an enemy who inhumanly sacrificed his men by the thousands to overrun a single position, an enemy who tortured his prisoners and who disdained the scruples of civilized nations, yet it threw back the aggressor and fought him to a standstill.

It fought nobly in spite of the fact that the Korean conflict was unique in our history. The cause was not solely national, but the cause of all free men. The issues were not as clear in the public mind as had been the case in other wars. Nevertheless, the United States Army successfully conducted its operations and produced the magnificent Eighth Army which has never been surpassed in its capacity to fight by any army in the history of the world.

The Army's peacetime contributions to the national welfare

and the development of our country are often overlooked, but the record of these contributions is an indivisible part of the record of America's rise to greatness.

The exploring and mapping expeditions which charted the course of our territorial expansion are known by the names of the Army officers who led them—Lewis and Clark, Zebulon Pike, John C. Frémont, to cite only a few. The westward migration of settlers was possible only because of these explorations and because the Army provided the settlers protection against the hostile tribes—protection to a far greater extent than could rightfully have been expected in view of its limited manpower.

The United States Military Academy was the first engineering school in America, and its graduates through the years have richly rewarded the Nation for the technical training they received. They were the indispensable engineers, the surveyors, and builders of the young Republic. They built our Nation's first roads and canals. That illustrious soldier, Robert E. Lee, as a captain, carried out an engineering project which literally saved the city of St. Louis as a prosperous commercial center by preventing the Mississippi River from changing its course and leaving the city miles from that vital avenue of trade.

The Army constructed the Panama Canal, considered virtually an impossible task. The canal is a tribute not only to the engineering skill of Army officers, but also to their medical knowledge and administrative ability. The Army established and operates the Alaska Communications System and built the Alaska highway through forests and over frozen muskeg from Dawson Creek across the Yukon territory to Fairbanks. Flood control and the constant improvement of our navigable waterways and our harbors, so vital to our commerce, have always been an Army responsibility.

In the light of this record, and the outstanding character of our professional military men, it is deplorable that the Army as a whole—more particularly its officer corps, and especially its senior officers—should too often be the target for irresponsible criticism.

The fundamental principle emphasized by President Eisenhower that ". . . professional military leaders must not be thrust into the political arena to become the prey of partisan politics" has too often been forgotten or flouted. There is a tendency to overlook the fact that the soldier is an integral

part of the community and is entitled to the same guarantees and is protected by the same Bill of Rights as every other American citizen. It is sometimes forgotten that it was the Army which played a major role in the foundation of this Nation and made possible the firm establishment of liberty, justice and individual freedom. The Army has successfully defended those principles in every war, and I propose to defend it and its prestige and integrity.

Ours is a superbly trained Army, ready to fight on any terrain, under any circumstances, whenever it may be called upon to do so. It is one of the toughest, most efficient, fastest moving armies ever known. Day by day it is becoming tougher and its striking power and mobility are becoming greater. Every activity that does not contribute to combat effectiveness is being eliminated. Although the fighting has ceased in Korea, the pace of training has not been slowed. New and improved weapons of unbelievable variety—both atomic and conventional—are giving our forces a punch which only a few years ago seemed beyond achievement. From bottom to top it is a hard-muscled, tough-minded Army, well trained and superbly led.

If I had to find a single word by which to characterize the officers of the United States Army, that word would be integrity —absolute, uncompromising integrity.

This includes both professional integrity and moral integrity. By professional integrity I mean unceasing striving to master one of the most complex, difficult and demanding vocations which exists. By moral integrity I mean loyalty to the American people, to the Government, to constituted civilian authority, and to the principles of truth, justice and liberty upon which our government is based. I mean as true loyalty to subordinates as to superiors—loyalty up, and loyalty down.

One often hears disparaging references to the so-called "military mind." I have heard apologists deny that there is a military mind. They are wrong. Of course there is a military mind, just as there is a legal mind and a scientific mind and an academic mind. It would be a sad commentary on the Army as an institution if it made no indelible imprint upon its members after years of training and service.

The "military mind" is one which seeks to anticipate and prepare for every eventuality. It is a mind capable of dealing brilliantly with the special problems which concern the military

security of the Nation. It is a mind conditioned by courage, by a tradition of selfless service, by the highest standards of character. It is, in short, a mind which measures every action by the yardstick of "Duty—Honor—Country." I fervently pray that our Nation will continue to develop such minds.

When I hear distinguished officers slurringly referred to as "the brass" it disturbs me greatly. I heartily endorse the sentiment of that eminent American, Bernard Baruch, who said: "In my experience, 'the brass' is all pure gold."

Men such as those who lead our Army today cannot and will not let America down in any respect—of that I am certain. The perpetuation of this hard core of able, dedicated officers and noncommissioned officers is of especially vital concern to the Nation as dangers and uncertainties beset us on every hand. The day that America allows this breed of men to die out through indifference, thoughtlessness or neglect, that day America signs her own death warrant.

It is of the utmost importance that everything possible be done to create an atmosphere conducive to the maintenance of a career military service, clothed in dignity and honor, which will be attractive to the highest type of young American. Nothing is more detrimental to the service than a feeling among its personnel that they are held in low esteem by their fellow citizens. Any action which fosters such a conclusion strikes at the tap roots of our security.

Unless the trend of recent years is reversed, and a climate created in which the development of military leadership of the highest type is encouraged, there will be little hope that, in the future, America will possess the kind of military leaders we are fortunate enough to have today and to have had in the past. The Secretary of Defense and other officials of the Defense Department, as well as Members of Congress, are giving the matter very serious consideration at the present time. However, it is not their responsibility alone. It is the responsibility of every American.

A very great and particular responsibility for our future security rests upon those charged with the training and indoctrination of tomorrow's leaders. To men of vision, of ability, and of high purpose it represents a challenging opportunity for service to America.

Battle Without Darkness

Lieutenant Colonel Henry J. Richter

THE RATTLE of rifle fire swelled to crescendo, punctuated by bursts from machine guns and mortars. A sudden glare of brilliant light flamed up on the battalion perimeter defense. Intense, but only a pinpoint in the vast blackness, it disclosed the silhouettes of enemy troops who had tripped over a wire attached to a field expedient flare.

In overwhelming numbers they were moving into the battalion sector. At first they appeared as dim shapes, then clearer as the whole area became suffused with light—almost the equivalent of a full moon. Under this artificial glow, the attack was stopped and a counterattack was organized to regain the lost ground.

This one episode brought into play a variety of devices used in battlefield illumination. The first flare that was inadvertently set off by the enemy was a type used largely in defense. The lighting of the sky was caused when battalion headquarters radioed for support from an artillery searchlight battery. During the action itself, light was utilized both in defense and then in offense by friendly troops.

Largely as a result of experiences gained in World War II and in Korea, greater emphasis is being placed on night operations by United States ground forces. Techniques for battlefield illumination are being perfected, and training of troops in night actions is being integrated into maneuvers.

United States soldiers have always been known for their ability to pit superior weapons and fighting efficiency against appalling masses of enemy manpower in daylight operations. But after nightfall, combat action habitually subsided except for infrequent attacks on limited but important objectives.

LIEUTENANT COLONEL HENRY J. RICHTER, Infantry, Editor in Chief of the European edition of The Stars and Stripes *from* 1950 *to* 1953, *is presently an instructor in the Tactical Department of The Infantry School, Fort Benning, Georgia.*

A variety of factors account for this. Night operations are difficult and potentially dangerous to the instigators. Besides the problem of maintaining control of units in darkness, accurate fire is practically impossible, and daylight may well find attacking troops in more confusion than the defenders.

However, our recent enemies recognized this weakness and turned it to their advantage. In World War II the Germans, knowing that American troops would generally pause at night and regroup, seized the opportunity to withdraw to better positions. In the Pacific island warfare, Japanese soldiers frequently staged night harassments or attacks. And in Korea the enemy exploited the habit even more belligerently. He assumed the initiative after darkness closed in, resorting to activities to reinforce positions, to bring up supplies, to infiltrate lines and to conduct damaging night attacks.

Problems of night combat are as old as warfare. In bygone eras, the fighting of necessity came to an end when darkness fell but usually, except for sieges or similar operations, the battle had been won or lost by that time. Often, however, the setting of the sun caused armies to retire or even to disintegrate. At the Battle of Hastings a body of retreating Saxons, discovering a large group of Normans pursuing them too closely, turned and counterattacked. Had not night interfered, they might have capitalized on this coup to turn the tide and possibly the entire course of history. As it was, they could not rally support in the darkness, and their only recourse was to continue their retreat to personal safety.

Armies camped in the field or entrenched have always been subject to night surprise; but difficulties of operations in darkness have always been so great that normal sentry and other security precautions usually have provided sufficient protection. Field expedients such as setting fire to haystacks or brush piles or even buildings have long been employed. Such measures in Korea were extended to include cans of napalm.

Obviously there are many advantages to be gained from illuminating the battlefield at night. It helps to overcome fear of the dark which is inherent in most human beings. Effective attacks started in daylight can be continued. The ability to observe at night with the naked eye denies infiltration or reinforcement opportunities to the enemy and forces him to remain under cover. Altogether, night battlefield illumination extends

the use of sound offensive tactics into the hours of darkness. Thus there is greater opportunity to increase the capabilities, mobility and radius of operation of friendly forces while at the same time restricting the enemy's freedom of action.

Early attempts at battlefield illumination were limited largely to pyrotechnics for defensive purposes. Flares, ground signals and signal lights were used to some extent in the trench warfare of World War I. Pyrotechnical lighting was and still is used in the form of projectiles tossed by hand, propelled from pistol, rifle or mortar, or dropped by aircraft. All except the larger aerial lights are limited in effectiveness. Even so, in Korea they proved of value..

Illuminating shells are provided for the 60-mm. and 81-mm. mortars of the infantry regiment, as well as the 105-mm. and 155-mm. artillery which usually fire in support of a regiment. The illumination from these larger weapons makes them useful in offensive as well as defensive operations. The shells provide sufficient light to permit aimed fire of ground weapons, adjustment of indirect fire, movement and observation closely approximating that under daylight conditions.

But a major disadvantage presents itself to the commander who desires to use his weapons to provide illumination. If he lights large areas for sustained periods he denies to himself the primary function of these weapons—supplying lethal fire in support of the troops.

Besides, supply problems are vastly complicated. As an example, three rounds of 60-mm. mortar ammunition are required per minute for continuous illumination of an area 350 yards in diameter. To produce the desired effect for four hours across a two thousand yard front of an infantry regiment in the attack. about twenty-six thousand rounds or approximately thirteen tons of illuminating shells would be needed. Not only would that create logistical difficulties but obviously the weapons should be employed to fire during an attack, rather than to provide illumination.

Although no aircraft flare has been specifically designed for support of ground action, use of such items has been quite successful. This flare has an intensity up to one million candlepower. When dropped from a plane, it parachutes slowly, providing light for an extended period. But adverse factors of weather, along with uncertain availability of aircraft and

enemy air activity, all limit its use for continuous illumination.

The introduction of searchlights marked a most significant advance in the solution of the entire problem. Such lights were used in World War I as antiaircraft defenses. The English even developed a searchlight tank fitted with a powerful projector capable of producing several million candlepower. It was known as the "Canal Defense Light," and was designed for pursuit of a routed enemy at night. Despite the efforts of a few tank enthusiasts, slight use was made of it and no techniques or doctrines were adopted for future use.

Until about 1940 little was done to study and improve night lighting equipment. During the early part of World War II searchlights were again used for air defense but with the advance of radar techniques the searchlight became outmoded in such night operations. However, in the meantime, the 60-inch antiaircraft searchlight was proving its worth in ground warfare. In some cases these were employed as a defensive measure to improve visibility and in others to assist in conduct of offensive action. As battlefield reports began coming in from France, Germany, Italy and the Pacific, the demand for such support increased.

From these experiences, commanders evolved advanced techniques. It was found that besides playing a beam of light directly on a critical area, good results were obtained by indirect lighting. Both direct and indirect lighting methods were therefore studied and improved.

The Korean conflict reiterated lessons learned in World War II and again demonstrated the advantages of battlefield illumination. At the same time, certain modifications were introduced. One was the mounting of the searchlight and its 16-kilowatt power plant on a 2½-ton truck for added mobility. Organization was clarified and techniques of field use were refined.

Artillery searchlight batteries—each consisting of three platoons, each with six searchlights—are today a normal attachment to Corps Artillery. Control is exercised by means of a light control center—corresponding closely to that of a fire control center for conventional artillery—liaison officers, and a wire and radio communications net. Usually the top commander exercises general control of searchlight employment to insure co-ordination and to prevent jeopardizing the operations of adjacent units. A battery may be given a mission of general

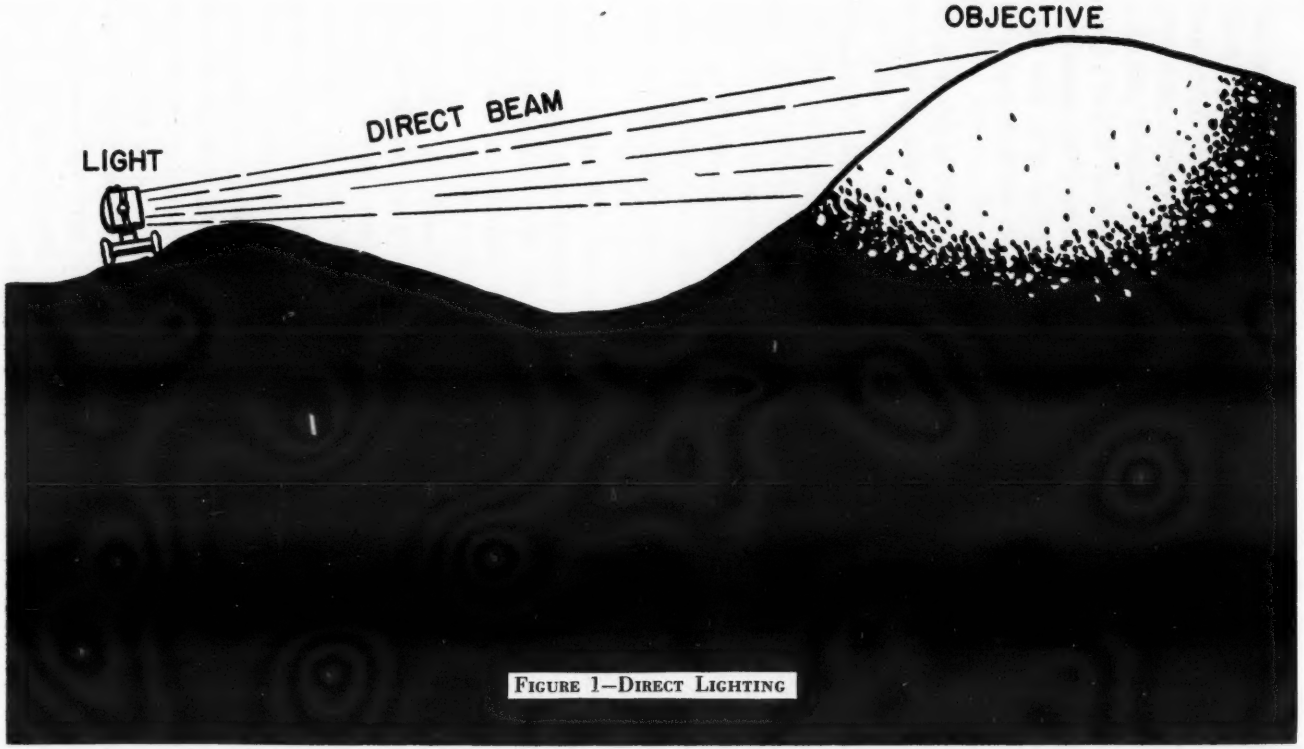


FIGURE 1—DIRECT LIGHTING

support to the force as a whole or of direct support to some particular unit.

The over-all plan for use of lighting may call for pyrotechnics as well as searchlights, or light shells may be prescribed as an alternative. Searchlights also may be brought into play through the same command channels as a request for artillery support.

As with artillery employment, great care must be exercised in placement of searchlights. They cannot simply be hurried into position and snapped on. Maximum effectiveness depends on such factors as terrain, mission and equipment capabilities. Provisions also must be made for security since by their very nature searchlights are vulnerable to enemy fire.

That vulnerability is not quite so great as might appear to the casual observer, however. It would seem simple for an enemy to shoot out a searchlight by aiming into the beam of light. But even in direct illumination, the problem of gauging the location and range of the light source is extremely difficult. Enemy countermeasures must usually resort to triangulation methods. When searchlights are used for indirect illumination, they are even more difficult to locate. However, they are often the target of infiltration tactics, with enemy patrols seeking to attack the light at is source.

Two types of illumination are possible—direct and indirect. With the direct method (FIGURE 1) a focused beam of light can be directed at an objective up to twenty thousand yards distant. The beam dazzles observers looking toward the source, causing temporary night blindness. It aids friendly troops in aiming direct fire weapons and permits supporting mortars as well as artillery to be used with greater effectiveness.

Direct lighting may pinpoint artillery or aerial support by laying two beams of light crosswise or it may channel enemy troops into prepared fields of fire. It is also of great advantage in supporting operations such as troop and vehicle movement, construction of bridges or fortifications, resupply, evacuation of wounded and so on.

In setting up the searchlight for direct illumination, care must be taken to provide for defilade in order to protect the equipment from enemy fire. Preliminary map survey, followed when possible by actual terrain reconnaissance, is essential before the battery commander assigns positions. He tries to place the searchlight between obstructions which will protect

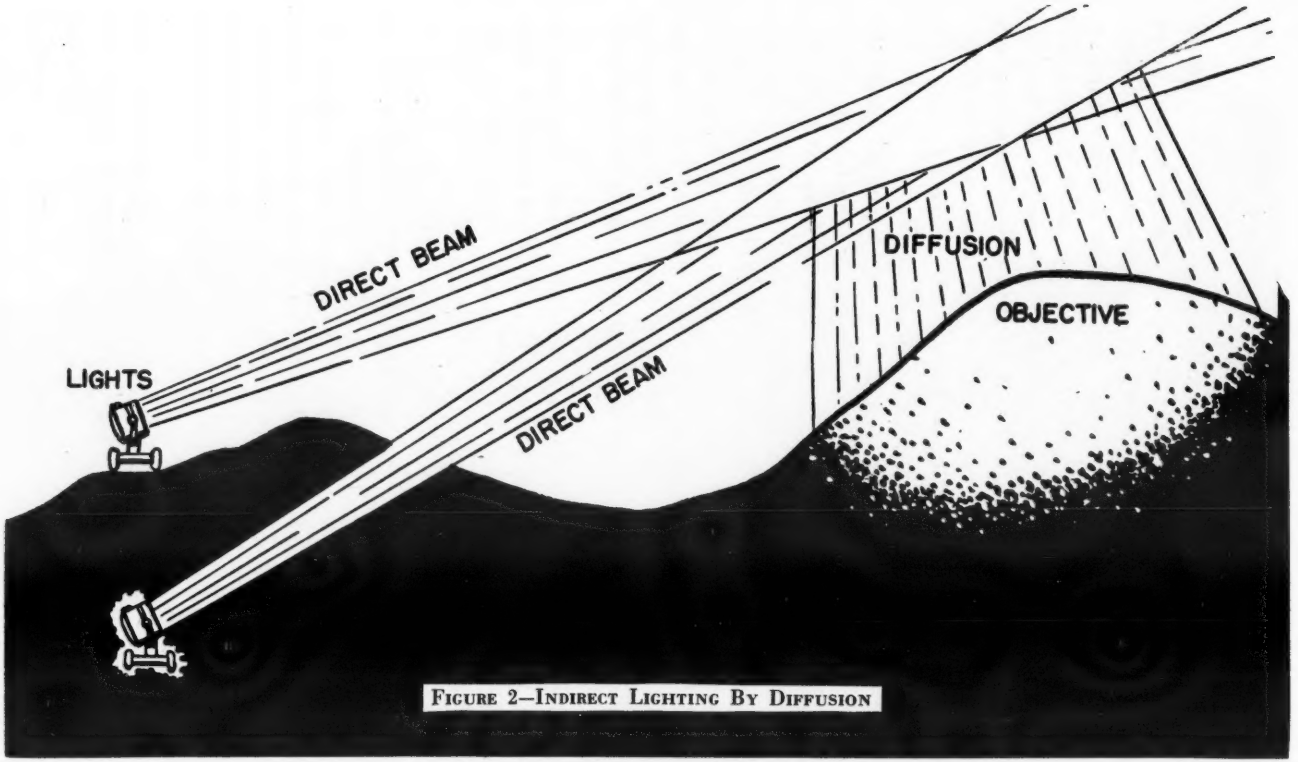
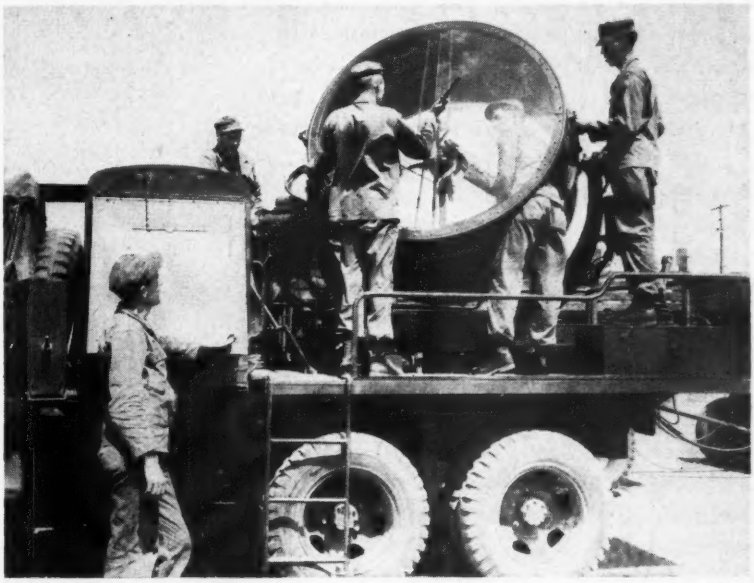


FIGURE 2—INDIRECT LIGHTING BY DIFFUSION

it from the side, yet which will allow the light beam to play in the desired direction. Sometimes the map may show an emplacement to be desirable from a topographical standpoint, but reconnaissance will reveal obstructions which may interfere with the best use of the light.



A searchlight crew readies its equipment before taking to the field on a night illumination mission. U. S. Army Photograph

Indirect illumination—also known as "artificial moonlight"—is obtainable by two methods—diffusion and reflection. For diffused illumination (FIGURE 2) the two beams are directed at a low elevation and at an angle to intersect above the area to be illuminated. When refracted by atmospheric particles, the light is scattered to the area beneath and to the sides of the beam. On a clear but dark night, lighting in this fashion will be equal to that of a quarter moon. A single beam laid on an elevation of fifty mils will illuminate an area eight hundred yards wide up to a range of fifteen thousand yards.

As in the case of direct lighting, the searchlight team must carefully choose its site of operations for indirect lighting. Ideally the searchlight is set up from two to three thousand yards behind a protecting barrier. Closer than that, the beam is projected at an angle which is not fully effective and moreover

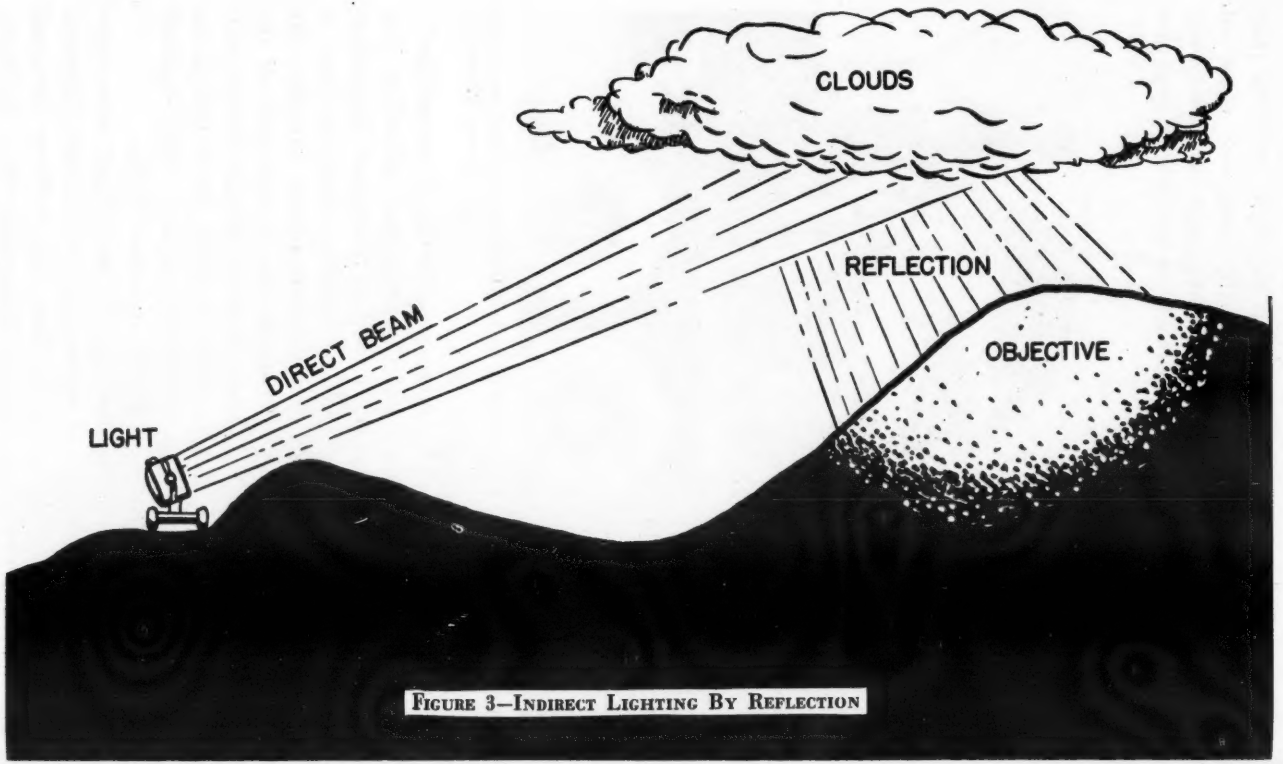


FIGURE 3—INDIRECT LIGHTING BY REFLECTION

gives the enemy a better chance to spot the equipment. A location farther back likewise reduces efficiency.

Under diffused lighting, friendly troops are able to operate their weapons effectively, although the aiming of hand weapons may prove difficult unless the front sights are illuminated. Enemy dispositions and movements are well lighted. Opposing troops, looking against the source of the light, see objects in deep shadow; their eyes are dazzled and it is difficult for them to operate hand weapons. And although friendly troops might on occasion be silhouetted and thus offer good targets, the advantages far outweigh the disadvantages.

Another form of indirect lighting depends upon the presence of clouds and is produced by directing the searchlight beam against low cloud masses which reflect the light below and to the side. Under best conditions, the intensity of light beneath the point of reflection is equivalent to that of a full moon.

This reflection method (FIGURE 3) was used with considerable success in World War II in Italy where at certain seasons low cloud banks are prevalent. Again, in the Pacific, the XIV Corps on Bougainville trained three searchlights on the underside of a cloud bank three hundred feeet above the objective, Hill 700. This illuminated the position so well that rifles and automatic weapons could repulse enemy infiltration attempts.

Friendly troops are able to observe enemy movement with either method of indirect lighting, and in some instances may direct their fire without additional aiming aids on the weapons. Under such conditions, the unaided eye can observe clearly up to two or three hundred yards and a man standing against a light background can be detected with an ordinary pair of binoculars at a distance up to nine hundred yards.

The work of the searchlight crew is never done. By daylight they observe and reconnoiter the area which they will illuminate that night. Searchlights may be withdrawn to a secure position during the day to prevent enemy aerial spotting and attempts to knock out the light by ground fire. Operations in mountainous terrain, which present problems of a large shadow area and limited elevation, add to the complexity of the task.

Enemy counter measures may involve more than attempts at direct destruction. Smoke screens skillfully used can nullify the effectiveness of lights. On the other hand, air currents may lift the smoke so that it serves as a cloud to diffuse or reflect

the light. The enemy also may adopt counter lighting measures but these usually are ineffectual since they further brighten the area under surveillance.

Nature itself may conspire to make night lighting difficult. Fog is impossible to pierce while dust storms also reduce the effectiveness of battlefield illumination. Paradoxically, artificial lighting adds little if the moon is naturally full and bright. The effect is much the same as turning on a lamp in a room full of sunlight. Consequently a dark, clear night is best for artificial illumination on the battlefield.

In general, the advantages of searchlight illumination greatly outweigh the few disadvantages which may be resolved by careful planning and control. In calling for illumination of an area, care must be taken not to affect adversely activity by adjacent friendly troops. The commander must be sure that nearby units are not conducting patrols or planning a major assault which relies on darkness for its surprise effectiveness.

Special training must be given troops in operating under artificial lighting. Unless properly indoctrinated, untrained troops fear that they themselves are liable to detection by the enemy. Troop training at night is thus a matter of growing importance. Actual unit field training, to include firing of weapons, is necessary to familiarize troops with the capabilities and also the limitations of battlefield illumination.

It is evident that the development of artificial daylight must be approached on a greater scale to make possible offensive operations on large fronts and in depth. The Korean conflict firmly re-emphasized the need to retain fire superiority and gave impetus to research and development.

Given proper illumination, it is probable that small unit tactics can be continued in darkness exactly as during daylight hours. Properly trained troops using advanced equipment and techniques, can reverse the long standing custom of suspending operations when night falls. Indeed, by thus extending the period during which our troops are able to employ their superior weapons and equipment with undiminished offensive power, the final outcome of battle can be speeded up.

The Army's Role In National Defense

General Matthew B. Ridgway

THE PURPOSE of an army—its task, its goal, its reason for being—is victory in war.

Throughout human history to date, there have been wars. During our own national existence the United States has found itself at war no less than eight times—once every twenty-two years. Today, the threat of war, which might materialize unannounced and with devastating effect, is ever present.

U. S. Army Photograph
GENERAL RIDGWAY

There was a time when the end of hostilities brought political negotiations; the imposition of reparations; the cession of territory. But for the government and for most of the people of the defeated nation, life went on much as it had before. Defeat for us today, or in the future, would be catastrophic.

The day when wars had limited effects is past. The physical and economic ruin sustained by defeated nations, their loss of life, the deterioration of their moral standards, are facts which recent history shows are indisputable. War, if it comes again, will be total in character. It will affect the whole social, economic and political fabric of the nations involved.

This has been brought about by the vast strides in technology which have occurred in the past century and a half and also

From an address by GENERAL MATTHEW B. RIDGWAY, Chief of Staff, United States Army, before the Cleveland Post, American Ordnance Association.

by the enormous increase in international economic interdependence which technological progress has developed. Today, war would not be waged solely between military forces, but between entire societies.

Moreover, the history of the past eight years, when the people of nation after nation lost their cherished freedoms, when subversion and the *coup d'etat* became the normal tools of unscrupulous and power-mad men, makes it clear beyond doubt that there exists a sinister threat to world peace.

It may well be that the time will come again, when we in America will have to fight to preserve the values we cherish. If we must fight, we must win. There can be no other goal. There must be no other outcome.

Against this background, and from my sincere and heartfelt convictions, I am going to speak to you about your Army and its role in national defense—a subject which can be approached from many directions but which I shall discuss from the viewpoint of men, materiel, and morale.

Man is the dominant factor in war.

We Americans view with distress the loss of life and the utter devastation which are hallmarks of twentieth-century conflicts. Our basic values, our fundamental beliefs all stem essentially from respect for the individual. This respect has many facets—the safeguarding of individual rights, the regard for human dignity, the respect for human decency, the conservation of human life. War sharply restricts our individual freedoms.

Because Americans treasure human life so highly, there are some among our people whose anxiety to find some means to reduce the human waste of war leads them into espousal of new and untested devices, machines and weapons in the hope that these can substitute for men.

No one could be more anxious than I to reduce both the manpower requirements of the Army, and its casualties in combat. At the same time, I have a responsibility to my civilian superiors in the Department of the Army and the Department of Defense, to the President of the United States, and through these officials to the American people. That responsibility stems from what I said earlier—that if our nation is forced into war, it must win. And I say to you now that notwithstanding new weapons with immensely increased destructive power, notwithstanding the developments in transportation which have brought

all points on the earth's surface within a few hours of each other, the ultimate determinant of military victory still is the trained fighting man with his feet on the ground.

It is true that man fights in three elements—in the air, on and under the sea, and on land. But man remains a land creature. The day of space ships and interplanetary bases still lies ahead.

The length of time during which this land creature can operate in the other two elements is steadily increasing. Yet it continues to be limited by the fuel, the ammunition, and the food which ships and aircraft can carry, and by the rate of consumption of these supplies. Airplanes still must land; ships must still make port. The bases from which they operate are still vulnerable to attack, and if destroyed or captured or even badly damaged, the fighting elements which they support can no longer operate effectively. But even if such destruction or capture were accomplished, there would still be no prospect that this alone would bring conclusive military victory. There would still be fighting armies to defeat.

The ultimate stake in wars is the control of bits of this earth's surface and of the people who inhabit them. It may be that at some distant date this control can be exercised by a threat from sea or sky alone. Yet it would be a dangerous, perhaps even a fatal fallacy, to conclude in 1953 that this date has arrived.

Deep-rooted in man is love of the land of his birth. This is as true in the lands of tyrants as elsewhere. In fact, history has shown it to be one of the strongest supports of tyrants who in their aggressive designs invoke its influence to divert attention from their tyrannies. If Communist-controlled regimes unleash war against us or our allies, we shall find this true. We shall be compelled, in order to attain victory, to break that control—and we shall not break it by threats alone.

England did not bow in 1940 to the threat of punishing blows from the air. Germany did not surrender in World War II, though her flag no longer flew at sea and her armies and peoples took the heaviest punishment of aerial bombardment ever known. Japan did not capitulate until her naval and air forces were destroyed, her armies decimated and isolated, her home islands wide open to the invasion of enemy armies which she no longer had hope of defeating.

The Communist forces in Korea did not yield to threats,

though the mastery of the seas around them, and domination of the sky above them by United Nations forces were all but complete. Logistical supply continued, even increased in effectiveness. At armistice time our enemy there had greatly increased the offensive capability with which he began.

We learn lessons from these historical facts. They prove what all of military history to date has proved, and with ever increasing clarity in modern times, that there is no magic in the successful conduct of campaigns—that sound planning and timely preparations of properly balanced military strength offer the only way we may expect successfully to defend ourselves.

Weapons incalculably more powerful than those of the past are now available and their power goes on increasing. Yet they, and the services which use them—and these now include all our armed services—have but one unchanging purpose—to deter aggression, if possible, and in the event we are attacked, to loosen the enemy's control over his means of waging war and so bring him to his knees. And, *mark this,* in the pursuit of this objective, the role of armies remains unchanged.

The problem of evaluating the effects of new weapons and new techniques is exceedingly difficult of solution. It is under continuing and intensive study. The Army will not neglect the potentialities of either the weapons we now have, or of those soon to come. We shall not fail to combine the new with the old; to adopt the new, when tests validate this course; nor to discard the old, for like reasons. And in doing this our Nation may, at some future date, substantially alter the ratios of land, sea, and air strength in our present military establishment. But no evidence yet adduced today would validate such a course. Perhaps it never will. New weapons, history shows, have a way of cancelling out. The advantage to the offense of one new weapon today is soon neutralized by the development of a corresponding one for defense. The domination of the battlefield by one nation, with new weapons and weapon techniques, is sooner or later counterbalanced by those of a potential enemy. Neither of the great power groups in the world of today can expect to maintain indefinitely both a dominant offensive capability and an assured defense.

Yet there is still one absolute weapon the employment of which dominates every consideration of national security—the only weapon capable of operating with complete effectiveness,

of dominating every inch of terrain where human beings live and fight, and of doing it under all conditions of light and darkness, heat and cold, desert and forest, mountain and plain. That weapon is man himself.

The striking technological advances of the past hundred and fifty years, while they have profoundly enlarged the scope and scale of warfare, have in no way diminished the importance of the human being in battle. Rather, they have increased his importance, and while subjecting him to greater hazards, have placed greater demands upon him.

Each of the changes in technical capabilities has brought changes in tactics. Each has required changes in organization. None has resulted in reduced over-all military manpower requirements. All have made increasing demands for skills and for leadership.

One of the most significant tactical developments has been the consistently greater dispersion of troops on the battlefield, and with it a steady decentralization of the responsibility for tactical decisions. The eighteenth-century sergeant's duties in combat revolved chiefly around the requirement to maintain alignment in his platoon, to see that men from the rear rank stepped forward to fill the gaps when men in the front rank fell. He would be utterly lost, if forced to fill the boots of the modern infantry noncommissioned officer.

In the Army today there are thirty-two distinct career fields. Each of these is a major specialty in its own right. To cite a single example of the standard required, a soldier of average or above average intelligence should complete no less than one hundred and twenty-eight weeks of training before he is properly trained to perform the duties of an infantry squad leader, before he should be entrusted with the lives of others in battle. For a platoon sergeant the necessary training time is greater, and for higher ranks, greater still.

Naturally, this is due in part to the increased complexity of weapons. But it is at least equally due to the increased degree to which tactical decisions must be made, effective leadership exercised, in even the smallest combat units. Thus, the soldier's capabilities have increased through the increased capabilities of his weapons, but the demands made upon his skill, his intelligence, and his character have likewise increased. These demands reach their peak in battle under conditions of maximum

danger, fatigue, and confusion. The measure of the soldier's response is directly reflected in the casualty lists. The Army more than any segment of our people wants those lists small.

A week ago, I returned from a trip to the Far East and Alaska. In the course of my inspection I saw the men in Korea alert to check and counter the possible resumption of Communist aggression. I saw the men who are keeping vigil in the North, standing faithful guard against possible attack which could come unannounced. In Greenland, in Panama, and along the Rhine, other American soldiers are ready for whatever emergency may arise.

These men are performing a vital service. It is their readiness, their presence in critical areas, which constitutes today another of the great deterrents to war. It is their presence which makes Soviet-led Communist aggression against friendly countries of Western Europe and of the Far East more improbable of success, and therefore less likely of occurrence. It is their presence on the far sides of the oceans which surround us, which heartens free men and women and strengthens the cause of freedom everywhere. Any premature withdrawal, any ill-advised weakening of their position can be a grievous blow to freedom.

I have been speaking to you of men, the basic element of armies. I do not underestimate the vital importance of weapons and machines. No army in the world has benefited more by the technical improvements in weapons than our own. Always anxious to gain maximum return from every ounce of human effort, every risk of human life, the United States Army developed its basic military doctrine around the concept of firepower, for firepower and the ability to maneuver it rapidly are foundation stones of our military doctrine.

This concept has been derived from the lessons of American history. At Bunker Hill, it was the intense and accurate volume of individually aimed fire which wrought great havoc in the ranks of the British troops, armed with muskets and bayonets, firing by volley on command. At Buena Vista, it was the rapid and destructive fire of American artillery, gallantly served by a handful of cannoneers, which shattered Santa Anna's charging troops. The trademark of the American soldier of World War I and World War II was the weight and accuracy of his fire in combat.

In Korea, once again, was demonstrated the value of the

close industrial support of our military forces. It was the massed firepower of the American soldier which balanced the weight of massed manpower of the enemy's callous "human sea" tactics. Thanks to the industrial productivity of the American people and to the strength of the American economy, our combat units today are the hardest hitting, man for man, of any army in the world. We have recently given our Army atomic weapons. We shall add others as time goes on. The increase in firepower will be tremendous. The effect on tactics evolutionary.

We shall continue to have in the future, as we have in the past, the most modern and effective Army, man for man, that can be produced, and the most economical, in terms of values the American people most cherish.

It is not possible to assess with any degree of accuracy the saving in life which has been made possible in battle by America's industrial productivity. However, some idea of the scale of industry's support can be gleaned from statistics on the production accomplishments of World War II. Between July 1940 and November 1943 alone, munitions output increased almost fifteen-fold. By August 1945, the total value of the munitions which had been produced since July 1940 exceeded 183 billions of dollars.

These impressive totals were achieved in spite of the shortages of manpower inevitably accompanying mobilization, in spite of the shortages of vital raw materials caused by enemy seizure of important strategic areas and enemy submarine interference with sea transportation.

I know that American industry, if called upon to do so, will match and surpass its magnificent achievement of World War II and of the past three years. Reliance on that great capability is one of the most important factors in the Army's ability to fulfill its function successfully. It is another of the major safeguards of peace.

So far, I have spoken of men and materiel.

I want now to talk about morale, the third, and in many ways the decisive element in the military trinity.

No matter how well armed, no matter how well trained, without that vital element of morale, without the will to win, the will to close with an enemy and destroy him, no army ever will win in war.

There is a maxim attributed to Napoleon that the moral

is to the physical as three to one. This is a truth to which every experienced combat soldier wholeheartedly subscribes, only he would, I think, greatly increase the ratio. Inspired by the will to win, the determination to prevail whatever the odds, men will in the future as they have in the past accomplish prodigies of valor. Our history is filled with examples.

I want to remind you of a few exploits of American troops which should be known to all our people. At Bastogne during the Battle of the Bulge, outnumbered, surrounded and cut off for eight days from any contact with supporting ground forces, our valiant troops under courageous leaders withstood onslaught after onslaught by numerically overwhelming and heavily mechanized enemy forces.

It is no detraction from this epic achievement to point out that, in essence, those gallant men of the United States Army were merely repeating an heroic pattern. Let me cite from the War of 1812 a local example, less well known than it deserves to be—the defense of Fort Stephenson, where the town of Fremont stands today, on the banks of the Sandusky River.

The fort was no more than a log stockade with rudely-built blockhouses. The garrison numbered hardly 160 men, commanded by Major George Croghan. The assaulting force comprised 400 British Regulars, including artillery, and some two thousand Indians led by Tecumseh.

Although the attackers completely surrounded the fort, although a horrible death at the hands of the Indians seemed the certain consequence of resistance, the Americans met the enemy's demands for surrender with steadfast refusal.

Throughout the night and most of the following day British cannon bombarded the little American garrison. Late in the afternoon, the British commander launched an assault by which he expected to take the fort by storm. The attackers were met by a hail of fire. After repeated assaults the enemy was driven off, abandoning not only the attack, but the entire campaign.

Through its gallant stand the garrison of Fort Stephenson not only saved itself from destruction, but so discouraged the British that other offensive operations against more important American posts in the Northwest were discontinued. Bastogne and Fort Stephenson are in the tradition of many of your Army's battles—New Orleans, Fort Sumter, Bataan, and Corregidor, and Chip Yong-Ni, Korea, to name only a few of the better known.

Not all of these battles were crowned with tactical success, but all were minor epics in the great current of American military history, and they all revealed what can be accomplished by men who fight with faith in God and in their ideals. They all show, as do innumerable examples, the ultimately decisive effect of the ultimately decisive factor—indomitable individual spirit, or morale.

Morale is not achieved by order. It is not something that comes from without. It germinates in the human heart—it feeds on the human spirit—it draws sustenance from kith and kin—it is intangible—a spiritual strength that enables men to endure sacrifices up to death for the things they hold dear.

It springs from a clear realization of what is most precious in life—what is worth fighting for, what is worth more than life.

It comes from a faith in the ideals and spiritual values which have made our Nation great and which have sustained us in every crisis. It is a faith which imbues men with a sense of privilege, not of enforced obligation, when they are called upon to serve the Nation and the cause of freedom. It inspires men to come to their great tasks as did the Fathers of our Country, who in the hour of decision pledged to the cause of liberty their lives, their fortunes, and their sacred honor. It imbues men with the spirit of those millions of gallant men and equally gallant women who, in all the wars our nation has been obliged to fight, saw the shape of things as they were and stood up to them in defense of their faith.

This is the spirit which makes sacrifice acceptable, hardship endurable, which overcomes doubt and the misgivings of timid hearts. This is the spirit which brings victory. It is the spirit which acknowledges no obstacles. It is American leadership at its finest, and the record of response to that leadership is among the proudest of America's annals.

The United States Army, representing and serving the people of the nation which created it, derives its strength and its spirit from that people, of which it is an integral part.

All earthly things are relative. All material things pass and are replaced. But spiritual values remain—constant, imperishable. As long as free men are endowed with an inextinguishable faith in God and an unquenchable love of freedom under God, as long as they harbor a burning determination to preserve their heritage of freedom, then no weapons, however new and

destructive, however awesome their potentialities may appear to be, can conquer them.

These are the elements—men, materiel and morale—which combine to make an effective Army. We can afford no other kind. The world is in an era of profound change. Whether this is to evolve in peace, or to erupt again in war is beyond our power alone to control. Because of this, war can come. If it should, then the final issue will hang again on the outcome of the struggle between men locked in land battles.

You may rely on your Army. With its sister services it stands guard today in the far-flung outposts of the free world, ready and resolved to play its full part in building collective security for freedom, in heartening our Allies who are in greater danger, in preserving the peace, and in winning in war, if war should be unleashed against us.

I am honored to join my fellow Americans in Armed Forces Day greetings to the men and women in uniform, at home and abroad. Their unrelenting efforts and unselfish devotion are the firmest safeguards of our heritage of freedom. I salute each of them as an expression of humble thanks for service so well performed.

Charles E. Wilson
Secretary of Defense

The Navy's Part— If War Comes

Admiral Robert B. Carney

STATED in its simplest terms the Navy's traditional job has been, and still is, to gain and maintain control of the seas. More specifically the United States Navy in conjunction with allied naval forces must exercise positive control over sea areas needed for our own uses and any other sea areas of critical importance to the enemy. The Navy also will have collateral tasks in support of the armies and air forces, and these additional responsibilities may be expected to increase in step with the Navy's ever-increasing range of tactical influence.

U. S. Navy Photograph

ADMIRAL CARNEY

By "sea" we no longer mean only the sea's surface. The air above the sea and the darkest depths below the surface are now part and parcel of a vast three dimensional strategic area. Both offensively and defensively our operations are being projected farther above the surface and farther below it. Strategic air attacks may approach their targets from seaward; submarines will stealthily approach the coasts to launch deadly missiles. Projectiles of all sorts will be triggered to their assault or defensive missions; some will carry atomic war-heads. The tidal wave of nuclear propulsion—although still barely visible—is rolling in; it is building to crescendo as surely as was the inevitable cracking of the atom itself. All of these things not only

From an address by ADMIRAL ROBERT B. CARNEY, Chief of Naval Operations, at the Naval War College.

complicate but increase the urgency of the sea-controlling job.

Make no mistake. The sea still is, and for the farthest foreseeable future will continue to be, the avenue for the movement of the vast majority of things and stuff and men that must be shuttled around in the prosecution of a war, and for the feeding of insatiable war industries.

The requirements of sea transport are not always understood, but an examination of the list of critical materials which our industry must seek from abroad would bring us to some gloomy conclusions if we thought the Navy could not keep the sea lanes open. Were we or our suppliers to be completely blockaded, the best we could hope for would be perilous isolation.

If this is a matter of such importance to this fabulously endowed country, what of England and Japan? What of the Mediterranean countries with their willing and intelligent manpower and their impoverished natural resources? All of the spirit and passion for freedom of such allies would avail but little if they were to be throttled by the enemy at sea. This is a very real threat which takes an important place in any New Look in search of the optimum strategy.

Our over-all strategy—the plan for making greatest use of available resources—is strongly influenced by our appraisal of the capabilities and intentions of potential enemies. Our Navy thinking must take Russian naval thinking into account. Russian ground strength has long held our attention; and it was in no small measure responsible for that urge for collective security which brought about the North Atlantic Treaty Organization. More recently, Soviet nuclear achievements have grabbed the stage and precipitated much sober thought—and a measure of hysteria. In the meantime there has been another manifestation of major Soviet policy which has been eclipsed in the public thinking by these developments, but it is one which merits our very serious consideration. That is Russia's developments as a maritime power.

Unobtrusively and without fanfare, she emerges as the second strongest naval power in terms of numbers of ships in commission—second only to the United States. She is flooding the shipyards of our allies with orders for merchant tonnage and she is building formidable combatant types in her own plants. She has recognized the importance of naval aviation and is improving that arm of sea strength. At present, in keeping with

her geographical position and basic naval policy, her naval air arm is land based but we cannot exclude the possibility that she may at some future time build aircraft carriers. Russia's navy is the one Soviet service that is more heavily manned today than during World War II.

These are unmistakable signs that portend a steadfast Soviet determination to make a bid for a powerful place on the seas. Our cue is obvious. Our own forces must be tailored, equipped and trained to meet the challenge if need arises—and to meet it successfully and decisively.

For our primary business of bossing the oceans in time of war, I see our operations including the old, savage, endless, nerve-testing campaign against the enemy submarine. I see our escorts plodding around the convoys and our Hunter-Killer groups employing every new device and weapon and technique. I see massive attacks on enemy naval bases and threatening air fields. I see ships and planes on vigilance patrols to warn of impending air attack on our shores and to shoot down the planes and missiles that threaten. I see the old, grim mine warfare though the mines and counter-measures may take new forms.

Guns with their limited ranges will become secondary to a family of swift and implacable missiles. Electronics will perform lightning calculations for attackers. Electronic battles will be waged between opponents—measure and countermeasure—momentary success, frequent frustration.

The Navy will respond to calls for support in the strategic air struggle. It will be prepared to supply the Army and to give some direct air support to the troops.

The Fleet Marine Force will provide a powerful and highly specialized mobile striking force to seize beachheads and to outflank an enemy's line of communications—a ready-poised element of the self-contained naval team which is conceived, equipped, trained and directed by a single great weapons system, understanding and dedicated to gaining and keeping mastery of the seas—the Navy.

These things we can forecast on the basis of our own objectives and our assumptions as to the capabilities and intentions of possible enemies. The crystal ball hints of other things but does not reveal them—the developments that would come about after the die of war is cast. All we can predict is that they will be merely new tools for the immutable fundamental role.

A future war, for example, might start with an aggressive act of sufficient magnitude to warrant prompt, large-scale retaliation. Then would follow a period when both sides would pick up the pieces, dust off the atomic residue, and make a re-estimate of the situation which might well result in their settling down to a struggle chiefly involving the old conventional weapons. Regardless of how the war is fought, one thing is certain. It will end on the ground, politically and economically even if not by frontal assault. Guerrilla bands armed with bamboo spears may stalk each other across the remaining ashes. But, and this is certain also, they will not walk on the water.

Future war will not change the Navy's basic role in the pattern of national defense. The campaign may be waged at a hitherto undreamed-of tempo; the destruction may dwarf all of the experiences of history; new and distant targets will come within reach; there will be crying need for electronics to supplement the capabilities of our inadequate human mental processes; there will be a greater interplay and mutual dependence among the services and between allied forces. But it will be the old familiar job of controlling the sea for our own use and denying it to the enemy.

Today, new concepts of war are being advanced as people ponder the effects of new inventions. These new concepts are often in conflict with time-tested procedures. Some zealots will oppose them; others, mistaking special applications for new principles, will religiously oppose everything else. Common sense shows that balance is needed. We must keep a watchful eye on both extremism and entrenched conservatism. Time moves, and we must move with it—and even ahead of it if possible; but time's applicable lessons should not be junked.

The factors bearing on grand strategy are constantly changing with the changing fortunes and trends of nations; strategic conclusions must be periodically reviewed. Therefore, strategy itself is a fluid thing, shifting under the influence of timely circumstances. The principles of war (the implementation of strategy) are constant, but strategy itself changes.

Changes of strategy will induce changes in emphasis with respect to the tasks of the several services, but the fundamental roles and missions are far less subject to change. Were war of serious proportions to be thrust upon us in the near future, the role of the Navy under the New Look strategy would be identical

in most respects to its assigned job in World War II; there would, however, be variations from the exact pattern of operations of the past. For example:

We must be prepared to utilize atomic weapons on naval missions;

We must be ready to assist and support our sister services in atomic operations;

We must be prepared to utilize either atomic or conventional methods depending on the way the conflict develops;

We must be ready to operate in conjunction with our NATO partners and the forces of other associated nations.

None of those things is a departure from our fundamental role; they are new, true, but they are merely adaptations of new things to old and unchanging principles.

The accelerated swiftness of passing world events, the increased emphasis in Soviet maritime growth, the future trends of sea utilization, the potentialities of nuclear propulsion, and the historic dependence of the world on sea communications—with these factors taken into account, I am convinced sea power is on the threshold of greater significance than ever before.

Here, a word of warning is very much in order. Allied sea supremacy is not an automatically assured fact. That depends on our composite efforts, our wisdom and our determination. Sea supremacy, like the sea itself, is something that the sailor—and his country—must never take for granted.

The increasing complexity of naval warfare raises an extremely important question. What sort of men will plan these forces? What sort of men will fight these complicated ships and weapons? Even a push-button must be pushed and it will still require intelligence to estimate P-moment. It will still take disciplined teamwork to prepare everything to respond to the push. It may require more guts and discipline than ever before to fight the battles of the future.

One thing is certain. No push-button will produce leadership, loyalty, quality, courage, character; and those are the essential ingredients of this weapons system which we call the Navy, no matter what the future may bring.

Certainly one of the most important roles of the Navy—in my opinion the *most* important—in peace and in war, is the developing of people who will be equal to the exacting requirements of peace-time preparation and to the gruelling ordeals

of a war that may be worse than anything yet experienced.

There is much that the Navy can do in this respect on its own initiative. There is also much to be done which can only be accomplished with the help of the Government and the people from whom it derives its powers and mandates.

The staggering complexity of modern warfare poses another problem with respect to the people who man our Navy. Today, no one man can master all of the tactics, techniques, capabilities and workings of the ships and planes and weapons and equipment of the Navy; a mere general understanding is no mean achievement. The moral is clear—decentralization to indoctrinated and trusted subordinates is mandatory. And there is an equally apparent corollary—a large measure of specialization is inevitable and the specialists must be accorded worthy goals within their specialties. Mark those points well, for the handwriting is on the wall and if we fail to discern its meaning, the Navy will suffer and will surely fall behind the times.

As an approach to the future, I would strongly urge an open-minded outlook with the hatch always cracked for the acceptance of new and sound ideas. I would caution against the danger of "compartmented mentality"—compartmented either in the sense of thinking of military power in terms of any single facet, or in thinking of war only as it used to be. This sort of thinking is perhaps as great a threat to the security of the United States as the ponderous capabilities of the Soviet Union.

The naval officer should never forget that naval strategy in its broadest sense will always involve the use of troops, ships, planes, military formations ashore and fleets deployed at sea. I cannot conceive of a major military campaign that would not involve full participation of all services and all capabilities of each, closely interwoven in the fabric of total national power.

Internally our profession is becoming ever more complex. We must recognize that the slide rule is replacing the rule-of-thumb; that sound research, development and building efforts are absolutely essential if the Navy is to carry out its future role.

This is a big order but we can not evade it. Whatever this great weapons system of ours may look like in the future, the brain and backbone and guts of it will be human intelligence, leadership and fighting spirit. The role of the Navy will always be to apply those qualities to the task of mastering the seas.

Our Defense in the Air

General Thomas D. White

AS A RESULT of more explosions behind the Iron Curtain, public interest and speculation is concentrated on the "defensive" weapons of air warfare—the interceptors and the guided missiles to be used against bombers. Reflecting this concern, the question is frequently asked, "Just what types of air defense can we now provide?"

U. S. Air Force Photograph
GENERAL WHITE

Short-range fighter planes and shorter-range missiles are weapons of defense, it is true, but they are not the only weapons against air attack. In the entire course of war they are not likely to prove the most effective means for stopping air attacks. By their very nature, interceptor fighters and antiaircraft guns and missiles on the home front are last resort weapons for a last-ditch defense.

Except for the highly important function of Civil Defense, the very last line of air defense is a line or circle of antiaircraft weapons to be fired from the ground. The newest and most effective of this type is the surface-to-air guided missile.

Like all purely defensive weapons which are fired from fixed positions, the new antiaircraft missiles have a limited application. Their range is very short when compared to that of even a fighter airplane; they are subject to electronic jamming; and they cannot be quickly concentrated or shifted from one point

From an address by GENERAL THOMAS D. WHITE, Vice Chief of Staff, United States Air Force, before the National Security Industrial Association.

of danger to another. In brief, these weapons are designed for that portion of an air war to be fought directly above our heads—which is the last place we want to have to fight.

The United States Air Force, which has primary responsibility for the Nation's air defense, is intensely concerned in preparations to resist an attack. It must be ready to fight back even from the bottom of our defense in depth. For this very necessary task, the new surface-to-air guided missiles are steadily being improved in accuracy and range. They promise not only to become a more effective substitute for antiaircraft guns, but also for the last, close-in efforts of interceptor airplanes.

The antiaircraft guns and missiles located near major targets form the only line of defense that exists in air warfare. Radar detecting installations are often mistakenly referred to as "radar defense." Actually they operate nothing but warning and tracking devices and are not in themselves a defense; however elaborate, they can defend neither a line nor an area.

The traditional and prevalent picture of military forces drawn up to defend both a line and the area behind it, is difficult to erase from our minds. In thinking of warfare in the air, it is necessary to remind ourselves repeatedly that the best-known ideas and images of ground warfare are not appropriate for air warfare, and they may even be misleading.

Against an air attack, it is not possible to defend a line because there are no lines in the air to be defended. War in the air takes place in space, which is infinite. Air space itself cannot be conquered or occupied or fortified. Its principal value is to provide a limitless number of avenues for attack.

Air space above and around warring nations can be used as a route of attack by any nation which possesses an effective air force. The nation having the strongest air force can make the best use of the air space by delivering the heaviest and most numerous attacks.

In so-called "defensive" air warfare, this air space is not used to reach and attack the enemy nation. Rather efforts are made to prevent the enemy from passing through a certain portion after he has already entered it. This is comparable to fighting with one's back to the ground.

Home front air defense alone can scarcely be expected to bring victory, or even to stave off defeat indefinitely, but it must be accomplished nevertheless. Once the enemy is in the

air and on his way, we must fight him the entire distance to the target and back again.

The next-to-last defense is provided by the interceptor fighter plane—a type which is both small and fast, but of limited range and endurance. It has, however, greater range than antiaircraft weapons fired from the ground. It can resist enemy bombers through a much wider volume of air space.

Interceptor fighter speeds, altitude range, and ability to attack in clouds and darkness are all being improved. Recently a new Air Force fighter, the F-100, became the first production model combat plane to exceed the speed of sound in level flight. Other supersonic fighter planes already are being built. For air defense purposes they must be designed to carry an increasing number of electronic devices because the enemy is most likely to attack when weather and darkness give him an advantage.

The fighter pilots themselves can expect to fight at a disadvantage so great that they may never find the enemy except with the aid of elaborate radar systems both on the ground and in the air. These devices, although essential for any around-the-clock defense, add to the pilots' burden and increase the requirements for skill and training.

The interceptor fighter pilot of today can go farther to meet his target than an antiaircraft missile can go. He can carry human intelligence farther in space and so is in a position to overcome some of the evasive tactics and deceptive maneuvers of the enemy bomber commander and his crews. His weapons have greater range, accuracy and killing power than in the past.

Fighter planes can now be armed not only with improved guns and rockets, but also with a new type of guided missile—the air-to-air missile. This airborne antiaircraft missile is smaller and cheaper than the ground-to-air missile but it is no less effective when a fighter plane flies it into position to meet attacking bombers. It can be shifted from one threatened point to another or concentrated in the air with the speed of flight.

Both types of antiaircraft missiles—surface-to-air and air-to-air—represent a much more expensive investment than the guns that have been used in the past, but they promise to be more effective. Even so, rockets and missiles are capable of shooting down bombers only after the enemy airplanes are identified, tracked and met in the right spot at the right time with sufficient strength to destroy them.

Well-handled bombing raids have a way of avoiding some of these combinations of circumstances. The ground-to-air missile has to wait for the bomber to come to it. The air-to-air missile has to be taken to the bomber. By deceptive feints, by radar jamming devices, by variations of courses and altitudes, and by swift and unpredictable concentrations, dispersions and withdrawals, bomber commanders have many ways of evading defenses at one point while saturating and overwhelming those at another. Like all military commanders throughout history, they have proved themselves capable of breaking through any thin and over-extended defense as long as they have a strong attacking force and retain the initiative.

The modern bomber can carry an array of electronic warning and jamming devices, and it will also be possible in the future for a bomber to carry missiles for its own defense. Bomber speeds and altitudes have increased rapidly. Thus the outcome of a fighter versus bomber struggle is no certainty, not even when the bomber has been detected, tracked and intercepted.

If we ever have to fight another great war, the most dramatic struggles of all history will occur as unseen and unseeing adversaries grope for their targets at the speed of sound, with the fate of hundreds of thousands hanging on the results of each duel in the dark. Yet even if we had a fully manned Ground Observer Corps to help fill the low altitude gaps in our detection system—and even if we had a fully manned Air Defense Command—we would still expect that some bombers would get through unopposed. The problem of having enough fighters in all the right places at all the right times to meet all attacks has never been solved in the past. There are few indications that it can be solved in the near future.

Any hope of having enough antiaircraft missiles on the ground to surround all targets and stop all attacks is even more fantastic. The sums required for a fighter and missile defense that could approach 100 percent effectiveness would bankrupt any nation and would yet provide no complete solution to the problem of how to avoid defeat in war.

In thousands of years of warfare, no one has yet perfected a sure system even for holding a line on the ground against a superior attacking force, so it is scarcely surprising that we have found no way to seal off the vast dome of space. Nevertheless, the more complete our system of home air defense—the

more swift and automatic we can make it by using every electronic missile and device that can be perfected—the better our position in any war. And while these last-ditch defenses cannot promise to prevent successful attacks, they can at the very least reduce their effectiveness by forcing the bombers to approach under conditions that would reduce accuracy and impose losses.

Fortunately, the true air defense of the United States and its allies is by no means limited to fighting upward with our backs to the ground. Well beyond the reach of our antiaircraft missiles and our interceptor fighters is a more extensive range for the application of airpower in air defense. This is the area within the radius of action of our bombers. It reaches over an enemy's own territory, over his land, sea and air bases, his fuel supplies and his supporting installations. There the enemy himself has to fight with his back to the ground.

No air force can long endure constant attacks against its bases, for its planes must be at rest on bases far more than they can be in the air. The planes, the bases and the communications necessary to keep the bases in operation are highly vulnerable to air attack.

Admittedly, we cannot call long-range bombers our first line of defense for the simple reason that there can be no line of defense as such in the air. But our strategic bombers are nonetheless our most potent defense weapon; for victory in air warfare is really the quickest and surest form of air defense. Not only can these bombers attack the enemy's own long-range planes, bases and installations on the ground, but also the deepest sources of supplies and materials that make it possible for his air force to be armed, maintained and operated.

Long-range, high-altitude bombers can now strike with precision even when bombing by radar. In Korea our medium bombers proved their ability to hit targets at night and in bad weather with greater accuracy than dive bombers in daylight.

Despite assertions to the contrary, the size of the plane and the altitude from which a bomb is dropped are not major factors in bombing accuracy. Medium and heavy bombers can, in fact, carry much more navigational and sighting equipment than can be carried in smaller planes. They can also carry more equipment for jamming enemy radar and more weapons for their own defense.

The principal disadvantage of the long-range bomber is the

fact that it can be detected and identified somewhat more quickly than a smaller plane. Near the few targets that an enemy could defend with heavy concentrations of interceptors and missiles, a small plane could more easily avoid interception but by the same token it could not reach the most important targets.

Already the United States Air Force is on the road to a solution to this problem. It has succeeded in turning long-range planes into air carriers for smaller, faster planes. These carriers can launch a small, short-range fighter plane—itself capable of carrying an atomic bomb—hundreds of miles from the target, and later pick it up for the return trip. Thus one of the awkward and costly features of air warfare in the past is being eliminated —the hauling or ferrying of fast airplanes to the scene of action by slow surface transportation.

In this new development, and in other ways of increasing its penetrating and striking power, the Air Force is strengthening and improving the first and foremost weapon of air defense —the long-range counterattack. This ability to hit back harder and farther than we can be hit is today, as it has been in the past, our surest and most indispensable defense.

The heritage of freedom must be guarded as carefully in peace at it was in war. Soldiers, sailors, airmen and marines have a real team-job to do in helping to provide for the safe-keeping of our nation. They can fulfill this assignment only with the help and constant support of Americans everywhere. Yes, our freedom can best be sustained when all Americans share in helping to preserve it.

Admiral Arthur W. Radford
Chairman, Joint Chiefs of Staff

Rockets In Warfare

I—The Flying Fire Arrow Flares Anew

FROM FESTIVE FIREWORKS to soaring supersonic space weapons is a far step but that, briefly, is the story of the rocket. Called the "flying fire arrow" by the Chinese who first used it in warfare in the Thirteenth Century, its evolutionary development has since followed a cyclical pattern of popularity and neglect. Use of rockets as defensive weapons was followed by their relegation to the role of fireworks; then came a revival of interest until the rocket competed seriously with artillery; again there was a period of almost complete oblivion, succeeded finally by today's renewed interest.

Indeed the resurgent rocket is of growing importance today both as ordnance and as the motive power for gigantic aerial weapons and pilotless aircraft. Rocket research currently shares the spotlight with atomic research and it does not take much imagination to foresee the day when atomic power could be wedded to rocketry to produce a new era in space travel.

World War II produced a crop of rocket weapons which only a few years previously would have appeared fantastic to anybody lacking a vivid imagination. Today those weapons appear less spectacular as world powers continue to develop larger, swifter, more deadly units. Some of those already tested can travel at several times the speed of sound to hundreds of thousands of feet above the earth.

In the United States all three military services are conducting advanced experiments with guided missiles or pilotless aircraft. Understandably most of the work must be wrapped in strict security. However when tests have demonstrated the acceptability of a particular weapon, or when the production stage actually has been reached, word is released to the public.

This staff-prepared article is based on interviews with DR. LOUIS T. E. THOMPSON and MR. FRED A. DARWIN of the Office of the Assistant Secretary of Defense (Research and Development) and data which was furnished by them.

Recently each of the military departments has announced that the production stage has been reached on one or more guided missiles. Meanwhile an extensive program of research and development is being continued on others, some of which are becoming available in limited quantities for service evaluation.

The modern rocket era is often popularly considered to have exploded, literally, with the impact of the so-called "buzz-bomb" on London in 1944. It was indeed the first impressive manifestation of the new era. Many military experts assert that if Germany had been able to introduce her new weapon six months earlier—or had been a year or so farther advanced in her research—the course of the war might have been changed. However, advancing Allied ground forces were able to capture the launching facilities for the V-1 and V-2 which had not already been destroyed by air power. The story of any future great war may be entirely different, so important have rocket weapons become.

Actually the new rocket era did not burst full grown on the military scene. It had its inception much farther in the past, in the laboratories and calculations of physicists, chemists and engineers. To a very significant extent, American pioneering provided the foundation on which other countries—particularly Germany—built their weapons. Years of hard work and the outlay of vast sums have enabled this country to catch up, until now the United States leads again in rocket research.

Looking at a modern rocket launcher assembly or at one of the huge missiles capable of carrying enormous destructability in its warhead, it may be difficult to realize that this weapon developed from the simple rockets that most of us have set off on Independence Day celebrations. Yet the principle—applied at least seven centuries ago in China—is the same. It can be illustrated by the reaction taking place within a vessel filled with pressurized gas, compressed air, carbon dioxide, steam, or gas created by gunpowder explosion—any gas, in fact. The gas presses against the walls of the container with equal force in all directions. But as soon as an opening is made in any part of the retaining wall, the gas will escape, causing thrust in the opposite direction. This thrust, measured by the rate at which momentum is developed by the escaping gases, is what sends the container flying.

The earliest application of the principle is lost in antiquity

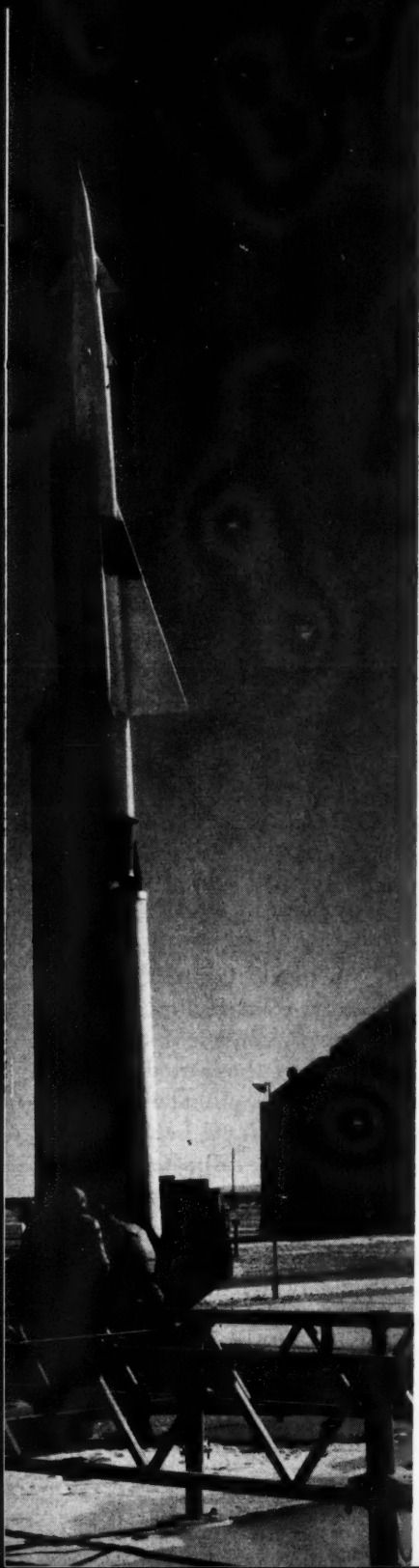
but it is probable that it was originally used only after the invention of gunpowder. Historians note the first reported use of rockets in 1232 A.D. during the siege of the Chinese city of Pien-king by the Mongols. As with other explosives, the Chinese undoubtedly employed it as a "fear weapon" rather than as ordnance. Rockets were thereafter used by the Chinese for both warfare and fireworks displays.

From China, knowledge of rockets spread to the Arabs, thence to the Byzantine Empire and by 1400 A.D. at least three types of war rockets are said to have existed. However their military application was not explored and they were used mainly at sea where riggings of sailing vessels offered conspicuous and highly inflammable targets.

Interest in rockets as weapons of war was dramatically revived when Indian troops directed them against the British in the early 1790's. The defenders of the city of Seringapatam are reported to have used over a hundred thousand rockets, each consisting of an iron tube weighing from six to twelve pounds which was stabilized in flight by a trailing ten-foot bamboo pole. Each carried a black powder warhead. Although not very accurate, they created havoc among the British cavalry. The British were quick to adopt the weapon and soon turned it against the defenders to help capture the city.

Experiments in rocketry quickly followed in England. Among those whose interest was kindled was Colonel (later Sir) William Congreve. Shortly after the turn of the Nineteenth Century he purchased from his personal funds the largest sky-rockets he could find in London. Their range, between five hundred and six hundred yards, actually was less than half of those used by the Hindus. Through assistance of his father, Lieutenant General Sir William Congreve, comptroller of the Royal Laboratory at Woolrich, he secured permission from the Minister of War to utilize the British Army's laboratories and firing ranges. Before long he had developed rockets with a range of two thousand yards. By 1806 the military authorities were sufficiently interested to make a thorough field test under war conditions and the port of Boulogne was bombarded with devastating effect. In 1807 Copenhagen was almost completely destroyed by a deluge of twenty-five thousand rockets.

From then on the Congreve rockets were an important item in the armament of warring European nations. His first rockets



weighed about thirty pounds, carried a "carcass" filled with incendiary mixtures, and were fused for time or impact burst. Most widely used was the 32-pound rocket with a 15-foot guide stick which served to stabilize the 4x40-inch warhead. These could be launched from racks or from tubes, usually at an elevation of from 55 to 60 degrees for maximum range of twenty-two hundred yards. Later Congreve developed a 42-pound rocket with maximum range of three thousand yards.

Rockets now were in wide use both on land and at sea. Francis Scott Key was so impressed with "the rocket's red glare" which he saw at the siege of Fort McHenry during the War of 1812 that he has forever commemorated it in our National Anthem. Rocket units were organized either as independent corps or as subordinate artillery units in European armies; the British Rocket Corps distinguished itself especially during the Battle of Leipzig (1813) which broke Napoleon's power. Later, the United States formed rocket units — although from existing records it is not entirely clear whether they were independent or artillery groups.

During the post-Napoleonic period, rockets provided serious competition with artillery. Congreve thought they would even-

A Nike *guided missile is prepared for launching at White Sands Proving Ground.* U. S. Army Photograph

tually replace artillery and for some time it appeared as though his views would be vindicated. Rockets were superior in range to the readily movable artillery pieces of his time — although fixed artillery had superior range. The rockets also provided greater mobility and highly concentrated volume of fire. They could be manufactured more cheaply than heavy ordnance.

But with improvements in artillery—development of smokeless powder, of the rifled barrel, and lightening of the pieces by use of alloy steels—artillery surpassed rockets in effectiveness.

One notable improvement in rocket design was made by William Hale who, prior to 1850, tried replacing the heavy guiding stick with three small metal vanes in the exhaust nozzle of the rocket. The stabilizing spin so produced, doubtless increased the accuracy. But with gunpowder for fuel, the range of his six- and twelve-pound weapons remained at about twenty-two hundred yards. The Hale rockets actually were used by United States troops in the Mexican War. From then on until World War II rockets were relegated to use as fireworks or as signalling devices or to carry lines to shipwrecked vessels which could not be reached by lifeboats in heavy seas.

The Aerobee *heads skyward from a Navy experimental ship in the North Pacific.* U. S. Navy Photograph

During World War I the employment of rockets as ordnance was not extensively explored. Some were used as signals; the Germans used a few large gunpowder rockets to destroy barbed-wire defenses; the French and Russians both used powder rockets fired from airplanes to set fire to German observation balloons. In the United States, Dr. Robert H. Goddard, a member of the Physics Department of Clark University, Worcester, Massachusetts, had by this time developed a bazooka-like projector for use as a trench mortar, and he was working also on a multiple-charge solid grain rocket. However, at the end of World War I work was begun on one of the most important stages in the development of the rocket—the liquid-fuel rocket. With the production of an improved type of propellant, a new rocket era was initiated.

Research with solid-fuel, multiple-charge rockets was begun in 1916 by Dr. Goddard. He had previously made exploratory studies of the possibilities in upper-atmosphere research using rocket-carried sampling and observing equipment. This resulted in a grant by the Smithsonian Institution in 1916 to support his work. Under his direction, research on solid fuel rockets was continued through 1918.

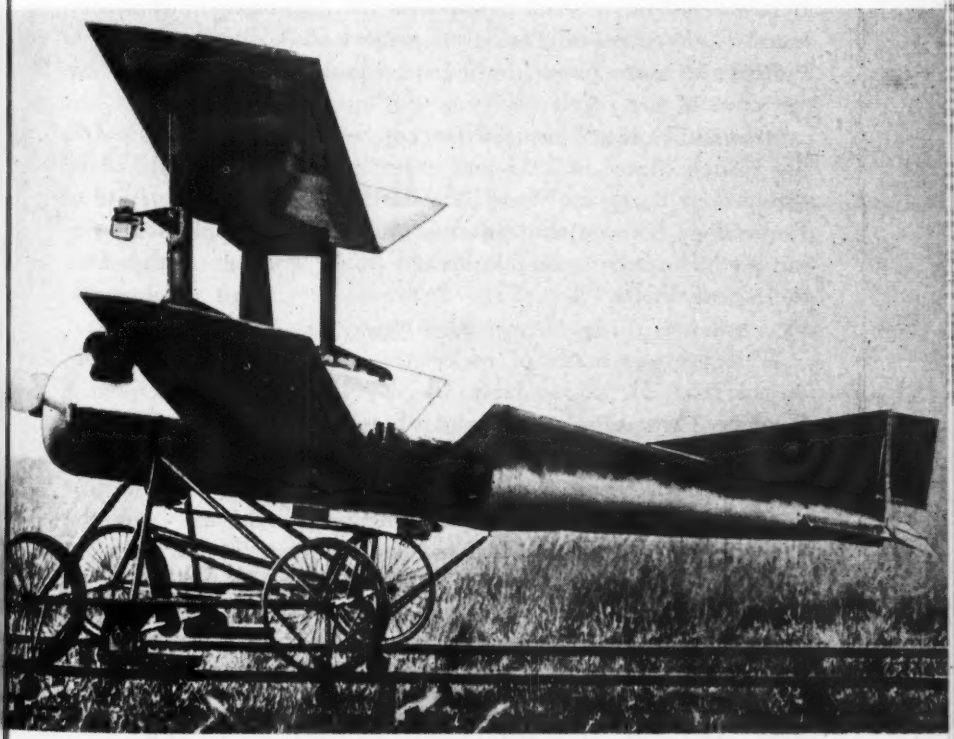
Shortly after World War I ended, the Smithsonian Institution also supported Goddard's first efforts on a controllable rocket designed to use liquids for fuel (gasoline with liquid oxygen). The first successful flight was made in 1926. A combustion chamber incorporating such advanced ideas as film cooling and a complete turbopumping system for both oxygen and gasoline, was subsequently developed in a later extension of his program sponsored by the Florence and Daniel Guggenheim Foundation at Dr. Goddard's Roswell, New Mexico, laboratory. A control system was developed employing jet vanes with a type of gyro reference, later used in the V-2 rocket. Many short-range, low altitude flights were made, demonstrating the basic elements of a system essentially equivalent to that developed for long-range applications in Germany during World War II.

It is on Dr. Goddard's experimental and theoretical work on rocket propulsion and rocket flight that much of the modern military application is now based. Early in his laboratory program he determined the measures of propulsion efficiency to be expected in a vacuum—an important factor in calculating its possible use at high altitudes. He was the first to design high-

performance rockets. He also patented designs for "step" rockets to allow firing of a rocket from another already in flight.

Although official governmental and military interest in rocketry was at a low ebb in the post-World War I period, commercial and scientific research continued to some extent. In Germany the automobile magnate Fritz von Opel built several racing cars powered by rockets. Efforts were made to propel railroad cars but none of these attempts was spectacularly successful. These failures—or at least lack of great success—came about largely because the rockets were grouped in banks. Some portion of the bank would fail to ignite, or all portions would ignite at once and cause an explosion. Opel and Max Valier also constructed rocket-powered airplanes late in the 1920's. They too met with scant success.

At about this time, Professor Hugo Junkers of Junkers bomber fame, worked out a successful method of using powder rockets



A World War I pioneer in the field of guided missiles, this craft was designed to carry explosives behind German lines. U. S. Air Force Photograph

to assist overloaded planes at take-off. The use of JATO (jet assist take off) units became familiar during World War II.

German's superiority in the rocket field is traced to a Rumanian, Professor Herman Oberth, who began his own investigations early in the 1920's. In 1923 he published a book, *By Rocket to Planetary Space*, in which he developed the engineering framework of rocket mechanisms. His work created such interest that by 1927 several German amateur enthusiasts had formed the "Society For Space Travel."

With the accession of Hitler, official assistance was soon forthcoming to the German society. The German Army moved in on the amateurs and took over in 1933, throwing up a screen of security. Soon more funds were made available and the huge *Peenemünde* project was established in 1936. It was there that work was pushed on the German rocket program which was to result in the first "buzz-bombs" and V-2's aimed against London. It is not too far fetched to say that the development stemming from the *Peenemünde* research project ranked second only to that of the atom bomb, both in size and cost, and in the importance of the result.

Meanwhile, the American Rocket Society was established in the United States in 1935 and experiments were stimulated by this group. Early in World War II, the California Institute of Technology became the center of a large development activity for aircraft and ground-launched rockets using double-base solid propellants.

II—World War II and After

Wide use was made of rockets by the major belligerents in World War II, particularly by the United States, England, Germany, Japan and the Soviet Union. Besides use as artillery, a beginning was made by the United States in various types of guided missiles—both bombs and aircraft. England was the first to use rockets on a large scale—an expedient of the desperate days after Dunkirk when it became imperative to fight off German air power with all available means. Rockets, used in lieu of non-existent artillery, soon were employed as both ground-to-air and air-to-air missiles. Many of the German V-1 bombs were shot down in aerial encounters which pitted rockets against rockets.

The Soviets developed the famous *Katyusha*, using this rocket to blanket German attacking forces and later as barrage artillery

to soften up enemy forces during offensives. The German *Whistlin' Willie*—officially the *Nebelwerfer 41* intended for laying chemical smoke screens—became unfavorably known to Allied troops. And on one occasion six *Luftwaffe* fighter planes equipped with folding-fin rockets shot down fourteen B-17E bombers, with no loss to the fighters.

When the United States entered the war, American forces were able to build on English experience. Among the best known of American developments was the Launcher-Rocket, AT, M1—the bazooka rocket M6 developed under the direction of Dr. C. N. Hickman and Colonel L. A. Skinner as a collaborative program of the Office of Scientific Research and Development and the United States Army. The use of a shaped charge in the warhead made it extremely effective. The charge explodes after the missile strikes at low velocity, producing a jet containing small particles traveling at ultra high supersonic speed. The jet will pierce thick armor plate.

The Army's bazooka projectile was at first made in a 2.36-inch size. A larger size, 3.5-inch, was developed before the end of the war but was not put into production. The great piercing power of shaped charge projectiles was again demonstrated during the Korean War.

Both naval aircraft and ships utilized rockets on a vast scale in World War II. One important contribution was the 3.5-inch anti-submarine rocket with a solid 20-pound warhead. The new weapon was first used successfully in January 1944 when a U.S. Navy airplane sank a German submarine while remaining beyond range of its weapons.

The OSRD group directed by Professor C. C. Lauritsen at the California Institute of Technology, collaborating with the United States Navy, developed and produced a whole family of rockets, ranging from an anti-submarine missile to 4.5- and 5-inch aircraft rockets which weighed over a hundred pounds and carried either high explosive general-purpose or armor-piercing warheads. The HVAR or *Holy Moses* was six feet long and weighed one hundred and forty pounds. The *Tiny Tim* rocket is about twelve inches in diameter, weighs nearly half a ton and when fired from aircraft is capable of producing the effect of a projectile from one of the 12-inch guns of a capital ship—although with less accuracy. All over the globe, naval aircraft used these rockets with devastating effect. Several large

merchant ships and some destroyers were sunk by rockets and vast quantities of the new missiles were used on island targets.

Ground forces, both Army and Marine Corps, used the rockets for antitank work, for offensives against troops and for laying smoke screens. Missiles ranged from the bazooka projectiles to 4.5-inch smoke rockets and 7.2 demolition rockets. The Army 4.5-inch M16 spin-stabilized field artillery rocket and the multiple-cluster light weight launcher T66 saw active employment in the European theater of war.

Modern rockets of small calibers and very high performance, such as the Navy-developed *Mighty Mouse* have become, since World War II, primary armament of certain Navy and Air Force aircraft for use against air and ground targets.

While rockets were being developed as ordnance, experiments were also being made with guided missiles and pilotless aircraft. Essentially any projectile may be said to be "guided" if it is aimed. The term "guided missile," however, refers to a missile controlled in flight after it is launched. This is accomplished in several ways, utilizing radar beams and homing devices for guidance.

Attempts at guiding projectiles date back to the early part of this century. With the development of radio, the use of radio control links became practicable for controlling the flight of aircraft. In 1923 the Naval Research Laboratory produced a pilotless aircraft control system which was successfully used to fly unmanned planes at the Naval Proving Ground. British experiments of a similar nature were conducted prior to 1920. During World War II radio controlled aircraft were in common use as target devices. In more ambitious efforts, worn-out bombers and fighters were loaded with high explosives and sent under radio control against enemy positions. Some flights of these so-called "Weary Willies" were successful, both in Europe and in the Far East.

Another World War II development was the use of glide bombs. These were conventional bombs to which wings and tail sections were added. The first ones were given a pre-set control program; later the use of radio control gave more accuracy. One of these, known as *Azon,* was used to blow up the Danube locks in 1944. Others were used in Burma. An improved type was known as *Razon.*

Among the new types of World War II guided missiles was

the *Felix*, designed to "home" on a source of radiation. Four of them were tested at Rabaul; three struck Japanese ships but one was diverted by the heat from a shore smokestack. The Navy produced the *Bat* radar-homing missile, a twelve-foot bomb with a wing spread of ten feet. It was carried aloft by a bomber whose crew selected a target and then set the radar guiding device. Capable of following the target despite evasive action, it was used successfully against running surface ships.

Two test models of a jet guided missile flying wing were produced during World War II. The second one, carrying a 3400-pound warhead, developed a speed of four hundred miles an hour. Other tests were conducted with rocket-assisted bombs, though they were not used extensively in combat.

While considerable progress had been made by the Allies under stress of the war, the German program was greater in scope, as was discovered when the war ended and evidences of German activity began to come to light. The explosion of the first V-1 or "buzz-bomb" in June 1944 had not been entirely unexpected since Allied intelligence reports of strange building projects ranging from Cherbourg to Calais had led to some advance knowledge of them. A program of bombing all launching sites was begun, and the Germans were forced to construct new and better concealed sites—a circumstance that is believed to have delayed initial launching by at least six months.

The German-built V-1 carried a warhead of about twenty-two hundred pounds in a 25-foot fuselage and had a wing span of nearly eighteen feet. A robot pilot maintained the bomb on a pre-set course. The missile attained a speed of three hundred and sixty miles an hour, outdistancing the early type British Spitfires. However, improvements in aircraft speeds soon enabled the RAF to shoot down many of the flying bombs. Some eighteen hundred were shot down by fighter aircraft; barrage balloons accounted for 232 more and antiaircraft guns and rockets intercepted another 1878.

With the V-2 however it was a different story. Where the V-1 was a pulse jet-propelled aircraft, the larger weapon was a true rocket. It needed no concrete take-off apron or tower which, with its tell-tale burned-out streaks, revealed its launching site. All that was needed was a mobile launching unit or a bit of solid ground; this often was provided simply by pouring out some of the liquid oxygen used for fuel and thus quickly freezing the

ground. The V-2 could be launched from well-hidden sites. Further, it had a maximum velocity of nearly thirty-five hundred miles an hour, flew a ballistic trajectory with a maximum ordinate up to about sixty miles, and was on target less than four minutes after launching. It could not be trailed and because of its speed there was no warning of its approach. All together, 1152 of these rockets were fired against England and 611 landed with devastating effect inside London. The Germans also fired 1341 V-2s against Antwerp in an effort to deny the port to the Allies.

When Allied troops overran Germany, teams rushed in to collect the German technical secrets. It was learned that the Nazis had been at work on a two-step rocket, weighing eighty-five tons, that was designed to bombard New York City by 1946. Its comparatively light warhead would have made its use extremely costly for the possible results obtainable.

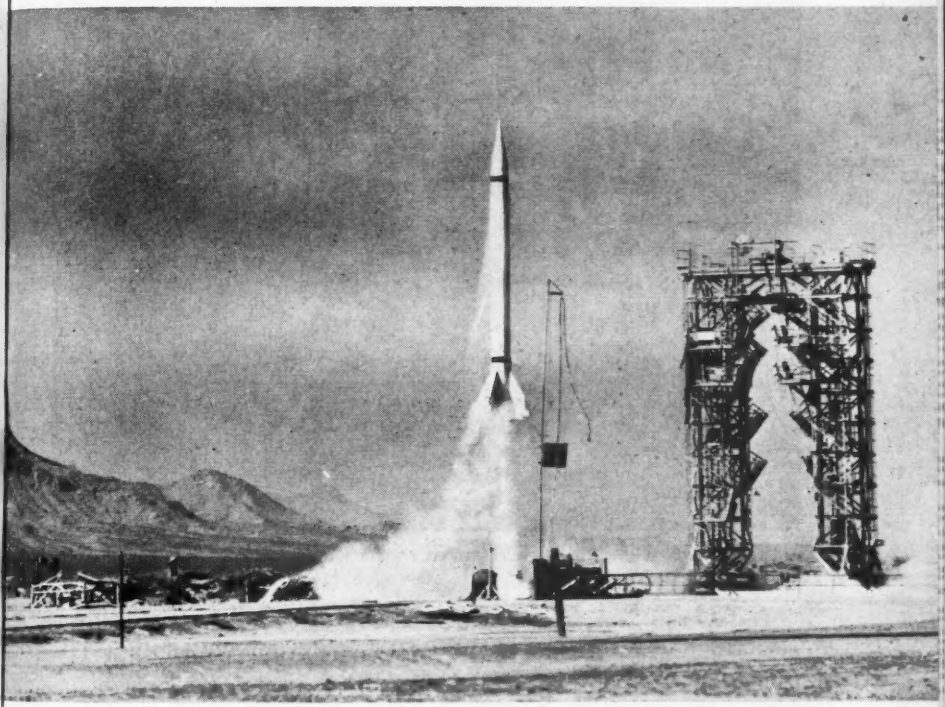
It was learned also that Germany had at least one hundred and thirty-eight missiles either developed or under advanced research. Many were entirely new types, using acoustic, magnetic field, infra red, wire, light beam, radio wave and other types of guidance. German scientists had been exploring the ram-jet method of propulsion and had flight-tested at least one unit. In addition, they had developed a wide range of rockets for air-to-ground, air-to-air and ground-to-air use.

Although the United States had lagged in the development and engineering application of rocketry prior to World War II, it is of interest to notice that rather extensive records are available for the flight tests of at least ten complete liquid-fuel rockets built and tested by Dr. Goddard during the period 1935-41 at the Roswell, New Mexico, development and testing area. These were, in effect, reduced scale prototypes of the V-2 design.

Immediately after the war, an extensive program of V-2 firing was conducted by the Army at the White Sands Proving Ground, New Mexico. Its purpose, in part, was to gain the extensive information needed for the guided missile program in this country and also to advance work on upper atmosphere research. (See "Research by Rocket," July 1952 DIGEST.) The firings also gave valuable experience in assembly, pre-flight test, launching, handling and firing of large liquid-fuel missiles. American-manufactured steering control systems and other guided missile components were tested. The behavior of the missile in flight

provided significant data for subsequent firings. Experiments were conducted using radar for ground control guidance and for detection and tracking of supersonic missiles in flight.

While work with the German-developed V-2 missile was of great importance during the closing period of World War II, the military services of the United States had by this time carried their own research to a significant point.



The Viking, *loaded with instruments for upper atmospheric research, is fired at White Sands Proving Ground.* U. S. Navy Photograph

By October 1945 the Army had launched successfully the *Wac Corporal* test missile. This was an experimental liquid-fuel high-altitude vehicle, developed by the California Institute of Technology in co-operation with the Army Ordnance Corps.

Considerably smaller than the V-2, it weighed only 655 pounds with fuel load yet attained a top speed of about twenty-eight hundred miles an hour. A significant advance in rocket study came in February 1949 when the V-2 and the *Wac Corporal* were combined in a multi-stage missile that employed the step-rocket principle. The *Wac Corporal* was carried aloft by

the larger V-2 serving as a first-stage unit, then was launched under its own power at high altitude. Nicknamed *Bumper*, this two-stage rocket attained a height of two hundred and fifty miles, a record for any man-made object. At the second stage the *Wac Corporal* flew at more than five thousand miles an hour and was in effect outside the earth's atmosphere.

Meticulous care and skill are required in the wiring and assembly of missile guidance equipment. U. S. Army Photograph

Today the Nation's armament program combines the three most significant developments to emerge from World War II—the atomic bomb, the supersonic rocket and radar. These developments have been welded into a guided missile program which has produced several units that can be put into service use.

During the years since World War II, several guided missiles have been developed to the point where they have been given public notice. The Army *Nike*, the Navy *Terrier* and the Air Force *Bomarc* are antiaircraft missiles which differ in range, guidance, and in adaptability to ground or shipboard launching. Surface-to-surface missiles include the Army's *Corporal* (not to be confused with *Wac Corporal* or *Corporal E*), a long-range surface-to-surface weapon; the Navy's *Regulus*, for submarine launching; and the Air Force's *Matador*, a pilotless assault bomber. The Navy *Sparrow* and the Air Force *Falcon*, both

air-to-air missiles, are intended for use on different types of aircraft. Other types of missiles have other applications, such as antitank, antisubmarine and strategic bombardment.

In addition, certain rockets are close relatives of guided missiles without really being classified as such. One group, the predicted-fire rockets, includes the Army's *Honest John* (surface-to-surface) and *Loki* (antiaircraft). Another quite important group includes missiles that are not weapons at all. These are the research vehicles, fitted with instruments rather than warheads and used to obtain information at great altitudes. The Navy-sponsored *Viking* has been largely standardized for high-altitude work. Substantial contributions have been made in Army work on *Bumper* and by Air Force experiments with *Aerobee*. Except for *Regulus* and *Matador*, the above mentioned weapons and research vehicles are all normal rockets—either predicted-fire or guided.

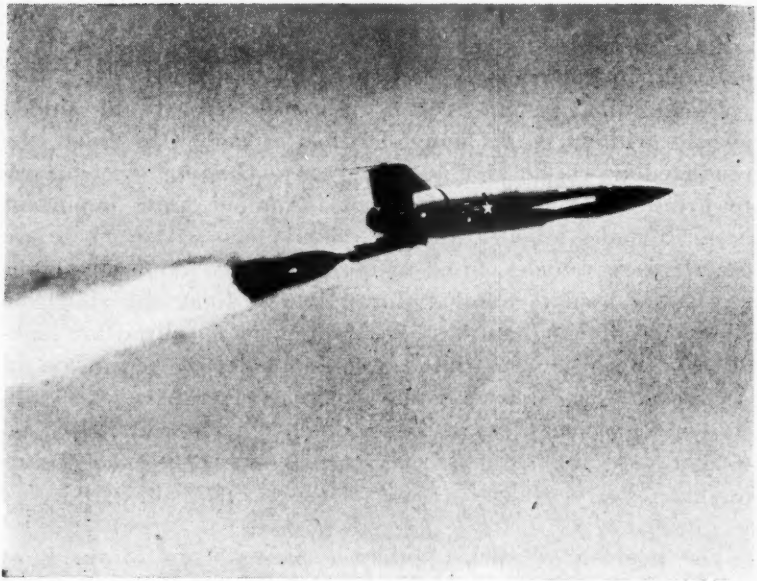
III—Guidance Systems

The problem of rocket guidance presents one of the most fascinating and difficult aspects of missile work.

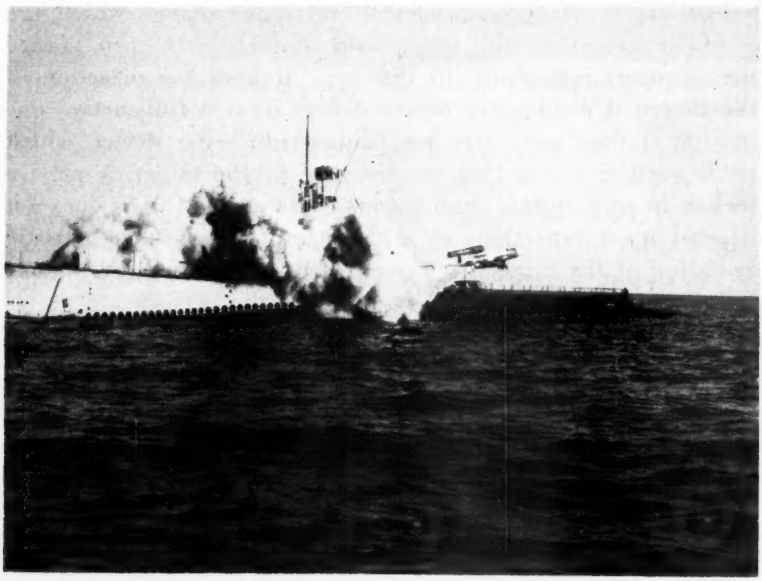
In *homing guidance*, the missile carries a "seeker", which tells it the direction to the target. Seekers are of three general types—fully-active, semi-active or passive. A fully-active seeker works like a complete radar; it sends out signals which are reflected back from the target, and it is made to turn toward the strongest reflections. In that way, it finds the direction of the target. A semi-active seeker differs from a fully-active one in that it does not carry an "illuminator"—the device which sends out the signals that are reflected by the target. A passive seeker, in turn, differs from a semi-active one in that it does not depend upon reflections at all. Instead, it uses characteristic radiation of the target itself such as heat or sound, so that no "illuminator" is required.

Still other types of missile guidance systems are beam-rider guidance, command guidance, base-line guidance, and self-contained guidance.

In *beam-rider guidance*, the beam of a radar at the launching station is kept trained on the target as it moves. The missile follows the beam from the point of launching to the target. Since the missile is always on a line between the launching point and the target, this type of guidance is sometimes called a form of "line of sight" guidance.



The **Matador,** *a pilotless bomber developed for the Air Force, streaks through the sky on a test run.* U. S. Air Force Photograph



The **Loon** *soars from the deck of a submarine.* U. S. Navy Photograph

In *command guidance,* radio signals are sent to the missile, causing it to change its direction as necessary to hit the target. One version, the two-beam, automatic command system, uses two radars, one of which keeps trained on the target, the other on the missile. On the basis of information from the two radars, a computer derives the commands that are sent to the missile to make it take a course to intercept the target. The commands are usually sent over a radar beam trained on the missile.

There are also single-beam command systems. In one version, a nominal course of the missile is established before it is launched. A radar tracks the target and feeds information to a computer which works out the command to shift the missile from its nominal, pre-established course to intercept the target. In another form of single-beam command system, the missile is tracked by a radar which continuously gives a computer the missile's position. The computer then compares that position with the location of a known fixed target and generates commands to change the missile's course to hit the target.

Base-line guidance systems employ the same general principles as single-beam command guidance systems against fixed targets, except that a base-line system, such as the loran (long-range radar navigation) system, is used instead of a radar to give the missile's location.

Self-contained guidance systems are comparable to autopilots; equipment carried by the missile is used to make it follow a predetermined path.

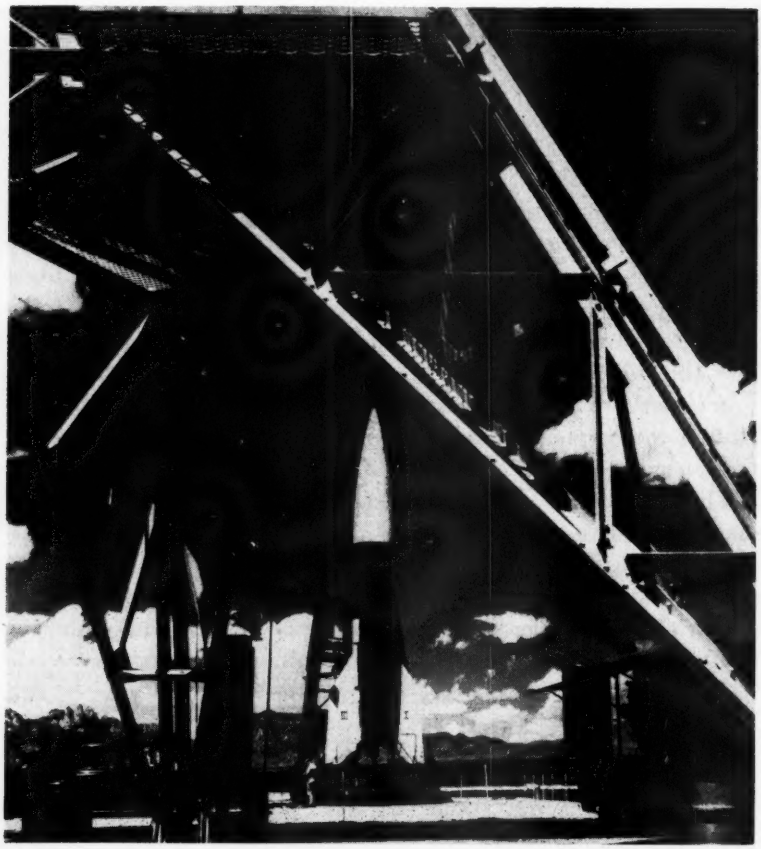
These guidance systems are essentially building blocks that may be used in combinations as required in various situations. Practically all missiles, for example, use at least some rudimentary form of pre-set or self-contained guidance, for stabilization of the missile. The guidance supplied by a radar homing head for instance, controls the missile to make it take a course to hit the target.

Furthermore, the systems mentioned are generalized ones. Elaborations as necessary and simplifications as possible may be applied. The *Tarzon* guided bomb for example, uses the same principles as command guidance for a fixed target, but employs visual sights instead of radars. In television guidance, a camera in the missile transmits images to a receiver at the operator's position, replacing a visual sight.

A wide gulf of something more than time separates the "flying

fire arrow" from the modern high-altitude rocket. While the rockets of preceding centuries were driven with a charge of gunpowder, those of today employ more efficient solid and liquid propellants. The possibility of atomic fuels has opened new alternatives.

The science of rocket research is still a matter for speculation and study but its potentialities are enormous. That these possibilities will be realized ultimately seems certain; and certain it is, too, that they will result in opening vast new horizons to mankind.



Athletics and Recreation At the Unit Level

Lieutenant Robert E. McAdam

WHILE military athletic and recreational programs strive for the same general objectives as do those in civil life, the aims of the service programs are defined more specifically. In the Air Force, Regulation 34-9 sets forth the program goals in these terms:

"To assist in maintaining a high state of morale and discipline;

"To aid military personnel in developing and maintaining physical fitness;

"To develop sport skills, techniques and attitudes through regular healthful exercise;

"To foster an aggressive and co-operative team spirit, increase the confidence of the individual, develop sportsmanship, and increase unit pride through participation in competitive athletics;

"To provide opportunities for developing spectator interests in athletic competition."

These separate objectives are all command responsibilities but in practice are frequently weighted in varying degrees according to the mission of the command, the locale and the past experiences and judgment of the commanding officer. But regardless of these variations, basically the program must be consistent with the over-all policy of stimulating, developing and maintaining the mental and physical well-being of service personnel through voluntary participation in many different off-duty sports and recreational activities.

Herein lies a major problem—how best to obtain mass support on a voluntary and individual basis.

FIRST LIEUTENANT ROBERT E. McADAM, USAF, is a mission navigator at Keesler Air Force Base, Mississippi. This article describes an athletic and recreational program which he developed at Chanute Air Force Base, Illinois.

Sample Inter-Unit Competition Schedule

WINTER QUARTER	SPRING QUARTER	SUMMER QUARTER	FALL QUARTER
Dec. Jan. Feb.	Mar. Apr. May	Jun. Jul. Aug.	Sep. Oct. Nov.
MAJOR ACTIVITIES			
Basketball	Softball	Softball	Touch Football
MINOR ACTIVITIES			
1. Boxing	1. Volleyball	1. Horseshoes	1. Bowling
2. Table tennis	2. Weight-lifting	2. Tennis	2. Handball
3. Card or other games	3. Badminton	3. Golf	3. Boxing
4. Pool Tourney			4. Card or other games
SPECIAL EVENTS			
1. Basketball Free Throw Contest	1. Bowling Contest	1. Golf Driving Contest	1. Target Throw Contest
2. Push-up Contest	2. Model Airplane Meet	2. Hole-in-One Contest	2. Archery Meet
3. Talent Contest	3. Fly and Bait Casting Contest	3. Swimming Meet	3. Skeet Shooting

Note: While all of these suggested sports and games are suitable for team activity, many are also adaptable to individual competition.

Actually, there are at least two reasons why military recreation programs may fail. First, excellence of performance rather than number of active participants is too often made the standard of reward and of recognition. This has the effect of encouraging only the few who are skilled while discouraging the majority who are unskilled. Second, unit commanders and others are frequently so absorbed in work relating to the accomplishment of their primary mission, that the voluntary participation programs are relegated to positions of lesser importance.

In an attempt to overcome these failings, a program employing a new emphasis was developed recently at Chanute Air Force Base, Illinois. Under the plan, special consideration is given to the *extent* of participation, rather than to *excellence* for its own sake. Personnel are encouraged to engage in activities which may be new to them—activities in which they might develop proficiency and interest. In addition, a competitive phase is introduced embracing those contests which are considered practical in the military environment. Recognition also is given to individuals or units possessing unusual talents or skills, thus simultaneously broadening the area of interest.

For convenience, the program is divided into four phases according to the seasons of the year. One major interest activity, two or more minor interest activities, and several special events comprise the program for each quarter. A typical yearly activity outline is illustrated in the accompanying chart.

To stimulate competitive spirit through unit accomplishment, a point system was devised. Scores and standings are posted on bulletin boards and at general meeting places within the installation so that everyone can see the progress of his outfit. The outstanding features of this point system are, first, that it is weighted heavily in favor of participation rather than winning, and second, that it makes provision for the equalization of credit points for units of varying sizes.

Every unit is awarded one point for each member taking part in one or more of the major and minor interest activities featured for that quarter. (A maximum credit limit for team sports discourages abuse by unreasonable substitutions.) One point also is counted for each person engaging in a special event.

An individual becomes a participant when he registers and takes part in the activity. Those who represent the unit in tourneys and league competition must qualify by taking part

in a certain percentage of the games played by the team. To compensate for differences in unit size, it is assumed that a unit of 400 men is capable of providing four times as many players as a unit of 100 men so the smaller one is granted proportionately greater credit. While this assumption is not absolutely valid because of such factors as unit mission, irregularity of working hours and the like, it does help to minimize the major obstacle to a fair awarding of participation points.

Each unit is likewise given points in accordance with the combined skill of its members. In a ten team tourney, for example, ten points are awarded the winning team, nine to the one placing second, and so on, with the tenth place team receiving one. Points are awarded individual activities—for example, five points for the winner of a special event, four for the runner-up, and so on down to one point for the fifth place winner.

To heighten interest by recognizing participation and skill of performance, appropriate awards in the forms of trophies, medals and certificates are made. Trophies go to the "outstanding unit of the year"—the one winning the greatest combined number of participation and performance points—and to the "outstanding unit of the quarter." Medals are given to individual winners and certificates to runners-up in each particular activity or special event.

Although this program demands considerable supervisory time, especially in computing and maintaining records of points earned, it does bring about two results worth noting.

The first is the greatly increased number of participants in a wide range of skill levels in all activities attempted. Second, unit pride and esprit de corps are raised noticeably. Such an inter-unit and intramural recreational program creates its own interest factor through balancing recognition for effort with actual proficiency. It encourages participation by many with varying abilities rather than by only a few of the highly skilled.

ARMY INFORMATION DIGEST, an official Department of the Army publication, is published monthly under the supervision of the Commandant, Army Information School, Fort Slocum, New York, on behalf of the Chief of Information, Department of the Army. The DIGEST provides timely and authoritative information on the policies, plans and operations, including technical developments, of the Department of Defense, the Department of the Army, the other services and the reserve components. Unless otherwise indicated, material in the DIGEST may be reprinted provided credit is given to ARMY INFORMATION DIGEST and to the author.

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The printing of this publication has been approved by the Director of the Bureau of the Budget, 21 May 1951.

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